TO COMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES

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Dedicated

to

my family

&

Teachers

LIST OF ABBREVIATIONS

AHA American heart association

ACC American college of cardiology

ADA American diabetes association

BMI Body Mass Index

BP Blood Pressure

BPD Biliopancreatic diversion

CCK Cholecystokinin

CI Confidence interval

DBP Diastolic Blood Pressure

DVT Deep Vein Thrombosis

DS Duodenal switch

DRS Diabetes remission score

ECG Electrocardiography

GTT Glucose tolerance test

Hb Haemoglobin

HbA1c Glycosylated Hemoglobin

HTN Hypertension

T2DM Type 2 diabetes mellitus

DRS Diabetes remission score

DS Duodenal switch

ECG Electrocardiography

%EWL Percentage excess weight loss

WHO World health organisation

SD Standard deviation

OHA Oral hypoglycaemic agents

LAGB Laparoscopic adjustable gastric banding

LDL Low density lipoprotein

LCD Low calorie diet

LPG-SG Laparoscopic proximal jejunal bypass with sleeve gastrectomy

LOAGB Laparoscopic One Anastomosis Gastric Bypass

MGB Laparoscopic mini gastric bypass

RYGB Roux en Y gastric bypass

SG. Laparoscopic Sleeve gastrectomy

SSI Surgical Site Infection

SBP Systolic blood pressure

TG Triglycerides

UGIE Upper Gastro Intestinal Endoscopy

VLDL Very Low Density Lipoprotein

VBG Vertical band gastroplasty

BPD Biliopancreatic diversion

WHO World health organisation

ABSTRACT

Introduction: Bariatric surgery is an effective treatment option for not only long-term weight loss but also declining the risk of cardiovascular diseases, reducing obesity-related comorbidities. The most common bariatric surgeries for obesity are Roux-en-Y gastric bypass (RYGB), Mini gastric bypass (MGB), sleeve gastrectomy (SG), LPG-SP (Laparoscopic proximal jejunal bypass with sleeve gastrectomy). RYGB surgery could reduce food intake and absorption by directly linking small stomach capsule and small intestine, which has been studied earlier and performed more frequently in patients with weight loss and diabetes. Moreover RYGB is most effective in treating patients with obesity accompanied by type 2 diabetes. Sleeve gastrectomy would remove about 70% of stomach volume and keep the main part responsible for digesting food.

Aim of Study: To compare outcome at the end of 1yr among various Bariatric surgery procedures.

Materials & methods: This was a retrospective and prospective study conducted in DMC&H, Ludhiana, on 86 Morbidly Obese patients who were admitted during 2017 to 2022, underwent different bariatric surgeries. Patients were followed upto 1 year after the surgery. The interpretation was done based on changes in the Body Mass Index, Fasting Blood Sugar, HbAc1, Systolic and Diastolic Blood Pressure reading and Lipid Profile and post-operative complications in these patients. Information was collected through pre-designed proforma for each patient chosen to be a part of the study with detailed history, clinical examination and complete investigational workup.

Results- Out of the 86 obese patients evaluated, 59.3% females and 40.7% males. Majority of the patients had diabetes mellitus. Significant reductions in FBS and HbA1c levels was noted. RYGB showed the highest reduction in FBS at 12 months. Significant reduction in BMI and weight was noted with maximum decrease in BMI in postoperative patients of MGB followed by RYGB at 12 months. There was significant improvement in HDL, LDL levels. Reduction in serum calcium levels was observed after surgery for which oral calcium supplementations were started. No major complications were observed post-surgery. Nausea, vomiting, diarrhea and infections were the most common complications with SG had the highest rate of nausea and vomiting. RYGB had the highest rate of post-operative infections. MGB had the highest rate of post-operative diarrhea and vitamin B12 deficiency, while LPG-SG had the highest rate of post-operative GERD.

Clinical Significance: The study had analysed the long term effect of various bariatric procedures on the weight loss, remission of various co- morbities like T_2DM, HTN, CAD and complication like infection, GERD in various bariatric procedures.

Keywords: Bariatric surgery, RYGB, SG, LPG-SG, MGB, WEIGHT LOSS, remission of T_2DM, HTN.

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INTRODUCTION

Obesity is defined by World Health Organization (WHO) as an "abnormal or excessive fat accumulation that presents a health risk." It has been recognized since ancient times, with Hippocrates suggesting that obesity is not only a disease but a harbinger of other conditions[1].

Obesity has emerged a leading global health concern. Overweight and obesity were estimated to cause 3·4 million deaths, 3·9% of years of life lost, and 3·8% of disability-adjusted life-years (DALYs) worldwide in 2017[2]. Obesity leads to high morbidity from hypertension, dyslipidaemia, type 2 diabetes, coronary heart disease, stroke, osteoarthritis, sleep apnea and respiratory problems, and endometrial, breast, prostate, and colon cancers[3].

Majority of the obese persons are in the developed world[4]. The main factors leading to obesity are consumption of high-calorie or high-fat foods, insufficient physical activity, and a shift towards a well-developed sedentary lifestyle[5]. Excess fat accumulates to the extent that reduces the life expectancy and lead to serious complications on overall health.

Psychological problems are also seen in overweight and obese[6]. Individuals suffer from social stigmatization and discrimination leading to low self-esteem and even depression.

According to recent data published by WHO, the prevalence of obesity nearly doubled worldwide since 1980. In 2014, more than 39% of the adults (18 years or older)were overweight with 13% being obese. In addition, at least 41 million children below 5 years of age were overweight or obese. Mortality rate is more among overweight and obesity today than underweight[7].

According to WHO, overweight and obesity accounts for 44% of the diabetes cases, 23% of the ischemic heart disease, and around 7–41% of certain cancer patients[8]. Among these, type 2 diabetes is most strongly associated with obesity and the risk is rising at high rate[9].

The treatment for obesity include non-surgical treatment and bariatric surgery. The goal is linked to the reduction of body weight. Non-

surgical options include lifestyle interventions like behavioural changes, diet modifications and exercise, pharmaceutical interventions. The currently available medications for the treatment of obesity, such as sibutramine and orlistat, are associated with only a 10% weight loss in responding patients[10] and sibutramine may be associated with statistically significant increases in blood pressure and pulse rate[11]. Non- surgical treatment have been disappointing in morbid obese patients. Bariatric surgery has proven to be a treatment of choice for morbid obesity[12], providing a sustained body weight.

TABLE A: WHO CLASSIFICATION OF OBESITY

Class	BMI
Underweight	< 18.5
Normal range	18.5 – 24.9
Overweight	25 – 29.9
Obese class 1	30 – 34.9
Obese class 2	35 – 39.9
Obese class 3	>40

Obesity is measured and defined in terms of Quetelets's Body Mass Index (BMI) which is a ratio of weight (kilograms) to height (square meter) of an individual. Normal BMI ranges from 20-25 kg/m sq. BMI >30 kg/m sq. indicates obesity. A BMI of >35 kg/m sq. and experiencing obesity related health conditions or >40-44.9 kg/m sq. is morbid obesity[13].

Morbid obesity in association with co-morbidities like Type 2 diabetes mellitus, Hypertension, PCOD comes under syndrome called 'metabolic syndrome' [14].

Type 2 Diabetes defined as an elevated fasting blood sugar (≥150 mg/dL), it occurs when the body does not respond correctly to the insulin, a hormone released by pancreas. Patients with diabetes often find it difficult to cope with multiple insulin injections. Their quality of life

can decline and a vicious cycle of non-adherence to treatment and poor glycaemic control is seen. Peripheral neuropathy, nephropathy, and retinopathy are significant complications of prolonged diabetes[15]. In recent studies it is observed that fat tissue changes following the bariatric surgery leading to improvement in insulin resistance, thereby reducing complications related to type 2 diabetes.

Hypertension is also a major co-morbidity seen in obese patients[16]. In central obesity, increased intra-abdominal pressure is the cause of systemic hypertension. These include increased renal venous pressure leading to activation of the renin-angiotensin-aldosterone system, with resultant glomerular capillary injury and proteinuria; direct renal compression with activation of the renin-angiotensin-aldosterone system; and/or an increased intrathoracic pressure leading to a decreased venous return and cardiac output with further activation of the renin-angiotensin-aldosterone system. The net effect of these physiologic disturbances is sodium and water retention, increased blood pressure, and the development of proteinuria, as seen in severely obese patients.

Hyperlipidaemia is a major risk factor for the development of atherosclerosis and coronary artery disease in morbidly obese individuals. Approximately 60-70% of patients with obesity are dyslipidaemic A new term recognized as “metabolic dyslipidaemia", the form of dyslipidaemia arising from concerted action of insulin resistance and obesity is the main driving force behind the development of dyslipidemia[17]. High concentrations of triglycerides (TG) with decreased high-density lipoprotein cholesterol (HDL-C) are its main characteristics. Low-density lipoprotein cholesterol (LDL-C) concentrations could be normal or mildly increased, although the number of LDL particles (LDL-P) can be increased. Dyslipidaemia is an important link between obesity and the development of type 2 diabetes mellitus, cardiovascular disease (CVD) and certain types of cancer.

Other diseases associated with obesity are degenerative joint disease as pain in the weight-bearing joints, urinary incontinence and gastroesophageal reflux. As earlier severely obese patients have

surgery, the less likely they are to develop hypertension and diabetes and presumably their associated complications.

Bariatric surgery is recommended for patients with body mass index (BMI) above 40 kg/m^2 or higher than 35 kg/m^2 when associated with comorbidities which include the different components of metabolic syndrome and type 2 diabetes[18].

There are various types of bariatric surgeries:

1. Purely restrictive

2. Largely restrictive

- Laparoscopic adjustable gastric banding
- Vertical banded gastroplasty
- Laparoscopic sleeve gastrectomy

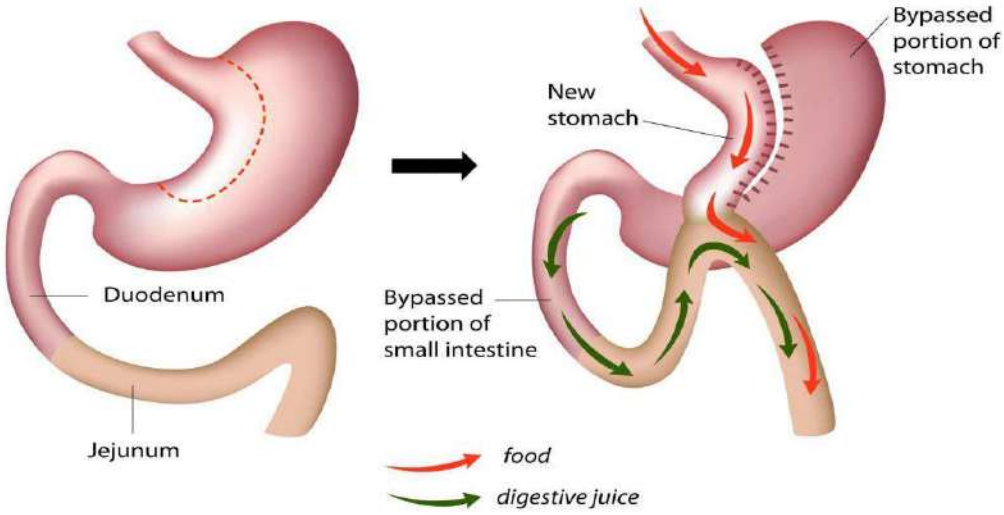
• Biliopancreatic diversion (BPD malabsorptive, mildly restrictive) with or without a duodenal switch

3. Largely restrictive, moderately malabsorptive

- Laparoscopic mini gastric bypass
- Laparoscopic Roux-en-Y gastric bypass

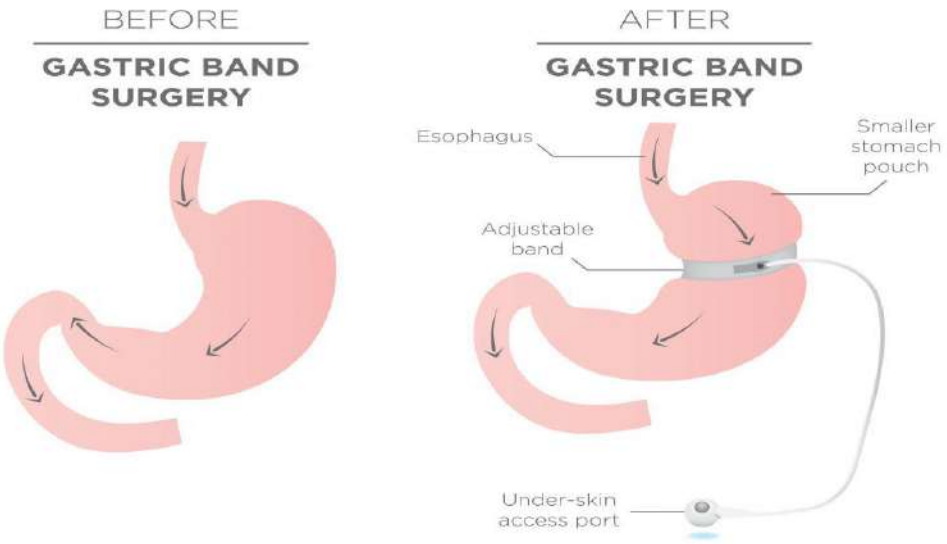
ROUX-EN-Y GASTRIC BYPASS- The stomach is divided and a small gastric pouch (about 30 mL) is created that is connected via a gastrojejunostomy to a distal segment of jejunum, which forms the Roux limb of the procedure. The remaining part of the stomach is referred as the “gastric remnant” and drains into the bypassed portion of bowel, referred as the “biliopancreatic limb”. Bowel continuity is restored for the biliopancreatic limb by a jejunojejunostomy, creating the “Y” configuration of the operation. So, the ingested nutrients proceed rapidly through the stomach pouch and move immediately into the jejunal Roux limb without bile and pancreatic secretions. Bile and pancreatic secretions drain via the biliopancreatic limb and then mix with the chyme/nutrients at the point of the jejunojejunostomy[19].

FIGURE A- ROUX-EN-Y GASTRIC BYPASS



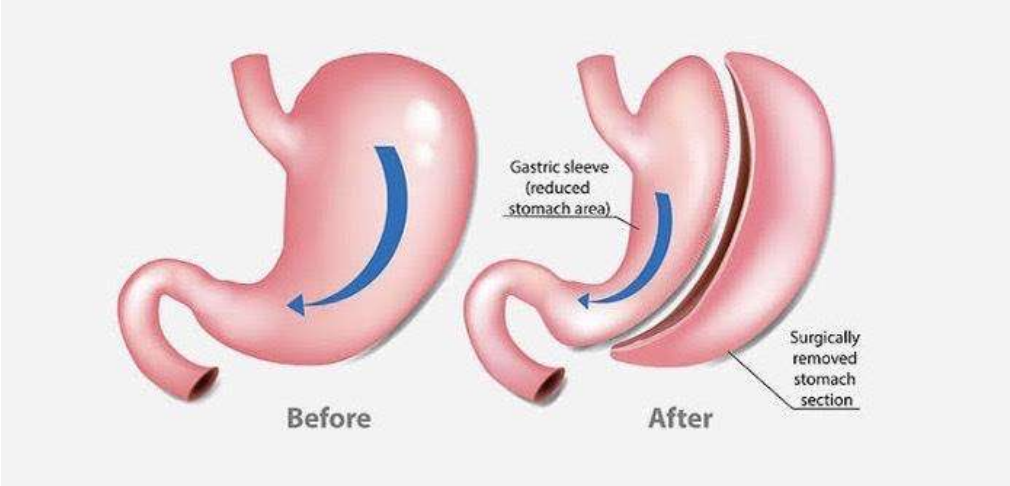
GASTRIC BANDING- In this surgical procedure, an external ring is placed around the proximal portion of the stomach and it has a balloon that lines the inner portion of the ring. The inflatable balloon is connected to a port in the subcutaneous tissue of the upper abdomen that allows the balloon volume, and then the amount of external gastric restriction is to be adjusted[19].

FIGURE B- GASTRIC BANDING



Laparscopic sleeve gastrectomy- This procedure involves a longitudinal resection of the stomach on the greater curvature from the antrum starting opposite of the nerve of Latarjet (branch of posterior vagus trunk) up to the angle of His. At first, the division of the vascular supply of the greater curvature of stomach is done which is achieved with the section of the gastro-colic and gastro-splenic ligaments close to the stomach. The greater curvature must be completely freed up to the left crus of the diaphragm to completely resect the gastric fundus that contains the ghrelin secreting cells of the stomach. Then after that, the second step is the longitudinal gastrectomy that “sleeves” the stomach and reduce it into a narrow tube[20].

FIGURE C- Laparscopic sleeve gastrectomy



Bariatric surgery is usually considered when other weight loss efforts have failed. Surgical interventions are considered as most effective method for long term weight loss. Long term survival is seen in surgically treated patients as compared to them with medical treated. However, in several studies, the resolution of diabetes has often been observed before a significant weight loss has been obtained.

This retrospective and prospective study was undertaken to compare the weight loss and resolution of various co-morbidities, post operative complication till 1 year post operatively in patients of bariatric surgery.

AIMS AND OBJECTIVES

AIMS

To compare outcome at the end of 1yr among various bariatric surgery procedures

OBJECTIVE

1. To compare the post operative outcomes in terms of change in BMI.
2. To compare the post operative outcomes in terms of control of Diabetes, and/ or Hypertension, Dyslipidemias
3. To compare the post operative complication among various procedures.

REVIEW OF LITERATURE

Obesity is a global pandemic affecting billions of adults worldwide. Obesity is linked to dyslipidemia, impaired insulin sensitivity, susceptibility to thrombosis, inflammation, and endothelial dysfunction, resulting in increased risk for cardiovascular disease, non-alcoholic fatty liver disease (NAFLD), and type 2 diabetes[21].

Bariatric surgery is the most efficacious long-term treatment for weight loss and improvement in obesity-related illness[22]. Bariatric surgery has been performed with increasing frequency around the world with better outcome than those observed with non-surgical therapies[23].

In a surgical technique known as single-anastomosis gastric bypass (SAGB) or mini-gastric bypass (MGB),its frequency of performance has increased considerably in recent times. Initially described by Rutledge, this procedure proposes a simplification of Roux-en-Y bypass by performing a single anastomosis, with a significant reduction of technical complexity, shorter operative time and a potential reduction in morbidity and mortality[24].

The Laparoscopic Sleeve Gastrectomy, often called the "sleeve" ,The Roux-en-Y Gastric Bypass, often called the “gastric bypass”, Adjustable Gastric Band , Anastomosis Duodenal-Ileal Bypass with Sleeve Gastrectomy are the most usually performed bariatric surgeries, with more fast and more significant weight reduction. In addition to the ability to treat obesity, these operations are also effective in treating diabetes, high blood pressure, sleep apnea and high cholesterol, among many other diseases. These operations also have an ability to prevent future health problems. The benefits allow patients with obesity who choose to undergo treatment to enjoy a better quality of life and a longer lifespan.

In many retrospective and prospective studies, female preponderance has been observed[25-27]. Kochkodan J et al.[28] in Michigan, only 22% male patients were in the study. Males tended to be older, with higher BMI, be married, have lower self-reported depression scores, and have more comorbidities (all $p < 0.05$). Postoperatively, males suffered more

serious complications than women. At 1 year postoperatively, males were significantly more satisfied with their operation despite increased complications, decreased weight loss, and decreased rates of comorbidity resolution as compared to females (all $p < 0.05$). Whereas, in case of females, increased psychological support in the perioperative period may lead to improved psychological outcomes like body image, depression, psychological well-being.

Bhasker AG et al[29] collected data from 2014 to 2018 to evaluate trends and progress of bariatric and metabolic surgery in India. 20,242 surgical procedures were performed in 2018 with an 86.7% increase from 2014. Laparoscopic sleeve gastrectomy continued to remain the most popular procedure, there is steady decline seen from 68 to 48%. One anastomosis gastric bypass showed an unprecedented growth from 14 to 34%. Numbers of laparoscopic Roux en y gastric bypass remained constant.

A study conducted by Ramon et al [30] 15 female patients with BMI over 40 kg/m^2 or 35 kg/m^2 with at least 1 severe comorbidity but <50 kg/m^2 were included in the study. Seven patients underwent RYGB and 8 SG. A significant reduction in BMI was observed in both groups after the surgery, and the mean BMI at 1 year was significantly lower in RYGB as compared with SG ($P = .016$).

Nguyen et al [31] reported 250 patients with BMI between 35 and 60 kg/m^2 were randomly assigned to RYGB (n = 111) or LAGB (n = 86). The mean % EWL was higher in the RYGB group than LAGB group ($P < .05$). The mean BMI was higher in the LAGB group than RYGB group ($P < .05$).

The study by Paluszkiewicz et al included 72 morbidly obese patients who were randomized to RYGB (n = 36) or SG (n = 36). Significant weight loss was observed after the surgical procedures, there was no difference observed between both groups at 1 year follow-up. % EWL in RYGB and SG groups reached 64.2% and 67.6%, respectively ($P > .05$) [32].

In a study conducted by Khalf AM et al on 20 obese patients reported, the mean age was 40.08 ± 2 years in SG and 42.03 ± 2 years in RYGB. There was a female dominance, with 12 of the patients being female and the remaining eight being male patients (male/female ratio 8/12) in both group. The mean BMI was 35.1 in SG and 35.3 in RYGB. All patients continued their oral hypoglycaemic medications before the operation. The operative time of SG was shorter than RYGB. The blood loss of SG was significantly lesser than RYGB. The average length of hospital stay of SG was 5.0 ± 4.1 days, which was significantly longer than RYGB, which was 2.89 ± 1.06 days. The early postoperative complication observed were. Minor complications (DVT in two patients, with one in each group, and gastroesophageal reflux disease (GERD) in three patients in SG group) and major complications (or overall surgical mortality) owing to pulmonary embolism (sudden death) in one patient in gastric bypass group. No postoperative bleeding or leakage was reported. Regarding post-operative complications, no statistically significant differences were observed between both the procedures in this study. At 1 week after SG, mean BMI was reduced from 35.1 to 34.3 kg/m ^{2}; at 3 months, mean BMI was reduced to 33.1 kg/m ^{2}; at 6 month, mean BMI was reduced to 32.6; at 9 month, mean BMI was reduced to 31.8; at the end of first year, mean BMI was reduced to 30.6, with a significant weight reduction ($P < 0.003$). However, after gastric bypass, mean BMI was reduced from 35.3 to 33.9 kg/m ^{2}; at 3 months, mean BMI was reduced to 30.8 kg/m ^{2}; at 6 months, mean BMI was reduced to 29.9; at 9 months, mean BMI was reduced to 29.3; and at the end of first year, mean BMI was reduced to 28.7, with significant weight reduction ($P < 0.001$). Optimal improvement was noted in all the metabolic disorders at 1 years[33].

Milone et al conducted a study in a total of 53 subjects who underwent sleeve gastrectomy or mini-gastric bypass for obesity and diabetes. Among these, 4 subjects were excluded because of surgical complications, 7 subjects were omitted because young surgeons conducted the operations and 11 subjects were removed because of

the lack of follow-up. Out of 31 obese patients, 15 males and 16 were females with mean age 38.32 ± 3.21 years; BMI: 44.78 ± 4.25 kg/m^2 were recruited for this study. All patients were diagnosed with type 2 diabetes [15 (48.4%) on metformin and 16 (51.6%) on metformin + insulin], 18 subjects (58.1%) reported hypertension and 8 presented with hypercholesterolemia. The mean glycemia value was 169.87 ± 35.76, and the mean HbA1c level was 8.5 ± 1.0. Among these, total of 15 subjects underwent SG (48.4%), and 16 patients underwent MGB (51.6%). After surgery, a significant and consistent reduction in BMI, glycemia and HbA1c values were noted. SG and MGB were associated with similar percent changes in BMI, glycemia and HbA1c. At 3 months post-operatively, diabetes remission was reported by 18 subjects (53.3% in SG *vs* 62.5% in MGB, *P* = 0.722). Similar results were noted after 6-months (53.3% for SG *vs* 68.8% for MGB, *P* = 0.473) At the 12-month follow-up, 66.7% of subjects who underwent SG achieved diabetes remission *vs* 87.5% of those who underwent MGB (*P* = 0.220)[34].

In a study conducted by Wei-Jei Lee et al[35] on preoperative prediction of Type 2 Diabetes Remission After Gastric Bypass Surgery, At 1 year after surgery, the percent weight loss was 26.5 % and the mean reduction in BMI from 35.7 to 26.2 kg/m(2). The mean HbA1c decreased from 8.8 to 6.2. A significant improvement in glycaemic control, including 130 (53.1 %) patients with complete remission (HbA1c < 6.0 %), 36 (14.7 %) patients with partial remission (HbA1c < 6.5 %), and 26 (10.6 %) patients with improvement (HbA1c < 7 %). Both the DiaRem score and the ABCD score predicted the success of the gastric bypass surgery, but the ABCD score was better at differentiating patients with poorer score.

Sohal et al[36] on ABCD score of > 6 predicts diabetes remission following bariatric surgery, At 6 months, the mean % EWL was 62.74. Significant improvements were noted in FBS, HbA1C, dose of OHAs, and insulin. Patients with remission were younger, with shorter duration of diabetes and higher C-peptide levels. Higher ABCD scores were significantly associated with higher rates of diabetes remission.

Sugerman J et al[16] conducted a study on diabetes and hypertension in severe obesity and effects of gastric bypass-induced weight loss showed that GBP surgery for severe obesity should be provided earlier to patients to prevent the development of diabetes and hypertension and complications associated with them. Out of 1025 patients treated, 15% had type 2 diabetes mellitus and 51% had hypertension. Among those with diabetes, 75% also had hypertension. Progressive increase in age between patients who had neither diabetes nor hypertension was seen, either diabetes or hypertension, or both diabetes and hypertension. At 1 year after GBP, patients lost 66 ± 18% excess weight (%EWL) or 35 ± 9% of their initial weight (%WL). Resolution of hypertension was noted in 69% and diabetes in 83% and these patients had greater %EWL and %WL than those who did not. There was marked resolution of other obesity related comorbidities noted. At 5 to 7 years after GBP , %EWL was 59 ± 24 and %WL was 31 ± 13; resolution of hypertension was 66% and diabetes 86%.

In a retrospective analysis of 284 patients by Mishra s et al.[37], 57% were females. Mean baseline body mass index (BMI) was 44.9 ± 7.9 kg/m^2. Out of total patients, 14.8% were diabetic. Mean %TWL at 5 years was $26.0 \pm 9.9\%$. T2DM remission at 1, 3, and 5 years were 78.5%, 71.4%, and 66.6%, respectively. Preoperative BMI ($p = 0.02$), glycosylated haemoglobin (HbA1c) ($p = 0.04$), duration of diabetes in years ($p = 0.04$), and preoperative insulin usage ($p = 0.04$) were the preoperative predictors for T2DM remission. Early(<30 days) complications were noted in 4.5% while late (> 30 days) in 0.7% of the patients. Weight loss after LSG was maintained in the majority of the patients, while some patients had significant weight regain at 5 years. In LSG, marked resolution of T2DM and other comorbidities was seen.

A retrospective 6-year analysis by Jamal M et al[38] on patients undergoing Roux-en-Y gastric bypass was performed. The indicators of resolution of hyperlipidemia were observed for 6 months and then at 12 months for 6 consecutive years. Out of total patients, 94 were diagnosed with hyperlipidemia and among them 23 were on medical

treatment. The mean age of patients was 39 ± 9 years, and the mean BMI was 50 ± 9.6 kg/m. Female predominance was seen. The mean baseline serum levels were noted as- total cholesterol 220 ± 42.2 mg/dL, triglycerides 212 ± 123.5 mg/dL, low-density lipoprotein cholesterol 135 ± 34.2 mg/dL, and HDL cholesterol 51 ± 12 mg/dL. The improvement in serum total cholesterol, triglycerides, and low-density lipoprotein cholesterol was seen in all patients after 6 months post-operatively. The improvement in HDL cholesterol levels was attained 12 months post-operatively. All patients who were on lipid-lowering drugs, no longer required the medication at the end of the study period.

In a retrospective cohort study by Charu G et al[39], on resolution of hypertension in African-American obese. Out of 169 African American bariatric patients, 86% were female, 67% were ≥ 40 years of age and 73% had HTN within 1 month of the planned bariatric intervention. The average BMI of the overall cohort was 48.50 kg/m^2 and the average age was 43.86 years. Obese hypertensive patients belonged to elderly age group (46 years vs. 37.89 years; $p < 0.0001$); had higher prevalence of DM and dyslipidemia. Prevalence of BMI and obstructive sleep apnea was not significantly different between the two groups. Comparison of the baseline characteristics of obese normotensive and obese hypertensive AAs enrolled to undergo non-revisional sleeve gastrectomy ($n = 31$) or RYGB ($n = 138$) surgery was done. Hypertensive AA who were taking ≥ 2 antihypertensive medications prior to RYGB were 18 times less likely to experience HTN resolution compared to hypertensive AA taking 0–1 medications, who showed full or partial response. Also, HIO was less likely to resolve after RYGB surgery in patients who needed ≥ 2 antihypertensive medications prior to surgical intervention.

A study by Sethi P et al [40] conducted on 91 morbidly obese [(BMI)>40 kg/m^2] and severely obese (BMI>35 kg/m^2) patients who underwent LSG. Patients were suffering from diabetes, hypertension or dyslipidemia. The patients were followed up for six months. A significant fall in waist and hip ratio was seen at three months and six months following LSG. Out of 66 (72.53%) patients who had

hypertension. There was significant reduction of systolic blood pressures at three and six months was noted post-operatively. Whereas, no significant change in mean diastolic blood pressures seen. Out of 51 dyslipidemic patients, majority of the patients showed resolution of dyslipidemia (serum cholesterol <240 mg/dl) at the end of 6 months. Serum LDL and serum VLDL levels also showed a significant fall at six months. A significant fall in serum HDL levels noted at three and six months post-operatively.

A prospective study by study by Jindal R [41] on 104 obese patients with T2DM who underwent LSG reported statistically significant reduction in the mean weight from a preoperative value of 129.1 ± 10.2 kg to postoperative value of 105.85 ± 10.30 kg at 3 months and 85.72 ± 9.65 kg at 6 months. LSG resulted in significant weight loss ($P < 0.05$). Fall in HbA1C and FBS levels were significant both at 3 months and 6 months postoperatively. Decrease in HbA1C and FBS levels from baseline preoperative values was observed. Out of total patients studied, diabetes was completely resolved in 82 patients (78.9%) at 6 months. Results showed that patients in younger age group and with higher BMI had better remission rates of diabetes than those who were older and with lower BMI.

So, this study was conducted to evaluate the outcome after bariatric surgery and effects on various co-morbidities.

MATERIALS AND METHODS

This was a retrospective and prospective study which was conducted in DMC&H, Ludhiana, on 86 Morbidly Obese patients who were admitted during 2017 to 2022, underwent different bariatric surgeries. This report presents the results of examined patients in 1 year after the operation. The interpretation was done based on changes in the Body Mass Index, Fasting Blood Sugar, HbAc1, Systolic and Diastolic Blood Pressure reading and Lipid Profile in these patients, and post-operative complications.

INCLUSION CRITERIA-

Patients considered for inclusion in this study are

1. BMI>32kg/m^2
2. Age 18 years-60 years
3. Undergone bariatric surgery for weight loss or co-morbidity resolution

EXCLUSION CRITERIA-

1. Lack of consent.
2. Patients requiring bariatric re-procedure
3. Advanced malignancies

METHODS OF COLLECTION OF DATA

Particulars of each patient were noted including name, age, sex, occupation, admission number and address for future correspondence. A written informed consent was taken from all the patients. Surgery was performed according to patient's choice/subject to fitness. Detailed history of each patient was obtained including history of presenting symptoms, any pre-existing co-morbid conditions and the patient's history including treatment and surgical history.

General physical examination and thorough systemic examination was done upon all patients at the time of admission. All necessary routine investigations were done. Pre-operatively and post-operatively at 3 months and 6 months, 12 months. All patients underwent specific weight and blood pressure measurements and laboratory investigations, as depicted in table -2

TABLE B- FOLLOW UP AT DIFFERENT TIME INTERVALS

	Before Surgery	0 months post-operative	3 months post op	6 months post op	1 year post op
BMI					
BP					
Lipid Profile					

Post op complications:

Pre-operative Evaluation-

The evaluation was done by a bariatric team which included the bariatric surgeon, dietician, endocrinologist, gastroenterologist, psychiatrist, chest physician, anesthesiologist, and the cardiologist. The pre-operative preparation of the patient included:

I: Counselling

All patients were counseled regarding

- Management options available for obesity, including diet, exercise, pharmacotherapy, and surgery.
- Expected weight loss
- Benefits in terms of sustained weight loss and resolution improvement of co-morbidities
- Risks of surgery including irreversibility of procedure
- General information regarding all surgical options
- Need for regular lifelong follow-up
- Strict compliance with the dietary, exercise and lifestyle medications advised before and after the surgery.

II. Nutrition Counseling

- Preoperative and post operative diet was planned in consultation with the dietician. The target weight was calculated in this session

III. Detailed patient interview to include the following

- Patient's complete medical history including history of Diabetes Mellitus, Hypertension, Hypothyroidism and other co-morbidities along with details of treatment duration.
- History of sleep apnea and snoring including the requirement for assisted ventilation, home-based oxygen therapy.

All patients underwent a comprehensive multidisciplinary bariatric evaluation, which included:

- Cardiology Evaluation: ECG, Echocardiography and if required, Stress Thallium.
- Gastroenterology Evaluation: An upper gastrointestinal evaluation/endoscopy (UGIE) was done to rule out reflux esophagitis, hiatus hernia, and gastric ulcers.
- Evaluation by Pulmonary physician included pulmonary Function Tests and Arterial Blood Gas Analysis.
- Endocrinology Evaluation for detection, assessment and management of diabetes and hypothyroidism.
- Psychiatric Evaluation to rule out any serious psychiatric disorder.

Special tests were done, when indicated

- UGIE and Biopsy-Helicobacter Pylori
- Venous Doppler was done to rule a previous or existing DVT

Peri-operative preparation

1. Patient comprehension was reviewed, and all patient queries were answered to their satisfaction. It was ensured that every patient undergoing bariatric surgery understood the following points:
   - Not all excess weight will be lost; only 50-75% EWL expected
   - Need for exercise after surgery
   - The importance of compliance with the dietary regimen (high protein, low sugar, low fat) after surgery
   - Need for lifelong follow up
   - Need for lifelong supplementation with vitamins/minerals/protein

   2 Regular Chest physiotherapy with the inventive spirometer.

3. Cardiology, Endocrinology, Medicine Gastroenterology, Anesthesia, Dietician and Psychiatry Re-evaluation.
4. Perioperative Antibiotic Prophylaxis:
    - Inj. Cefuroxime 1.5 gm was given half an hour before surgery and then was continued 12 hourly for 24 hours.
5. DVT Prophylaxis
    - Intermittent calf compression pumps were used intra-operatively and continued post-operatively till the patient was discharged
    - Inj. Clexane (or an alternative low molecular weight heparin) was used. The first dose was to be given 6 hours after surgery and continued post-operatively for 10 days.
    - The patient was mobilized early preferably on the day of surgery

Informed Consent

A detailed written informed consent was obtained. The patients were explained the purpose of the study. The proposed benefits and risks of the surgery were informed in detail to the patient. The patients were explained that their refusal to take part in the study would not affect their treatment in any way.

Diet Management

Pre-operative Period

Patient underwent a complete nutritional evaluation by a dietician. The patients were started on a low-calorie diet (LCD) during the first visit, around 1000-1400 kcal/day and were encouraged to do physical activity daily. Around two weeks before the surgery, the patient was shifted to a very low-calorie diet (800-1000 kcal/day). It is a liquid diet with meal replacement supplements. Diabetic patients were monitored closely as the requirement of oral hypoglycemic agents/insulin decreased during this period.

1 day before surgery, the patient was put on a clear liquid diet.

Post-Operative

The patients were allowed orally on post-operative day 1. They were kept on a clear liquid diet for 1 day and then shifted to the liquid diet. They were gradually transferred to a pureed diet depending on the

tolerance of liquid diet after 15 days to 1 month. “Pureed” means that all food has been found or mashed to a consistency of a soft, smooth, thick paste similar to a pudding.

In the follow-up period, diet was modified according to the presence of any nutritional deficiency.

OUTCOME

The outcome of the study was assessed by monitoring the following parameters:

1. Weight/BMI
2. Blood Pressure
3. Fasting Blood Glucose/HbA1c
4. Lipid Profile: Serum Triglyceride Level, High-Density Lipoprotein (HDL), Low- Density Lipoprotein (LDL), Very Low-Density Lipoprotein (VLDL)
5. Post operative Complications

TABLE C- DEFINITION OF DIABETES OUTCOMES AFTER BARIATRIC SURGERY

Outcome	Definition
Remission (complete)	Normal measures of glucose metabolism (HbA1c<6%, FBG<100 mg/dL) In the absence anti-diabetic medications
Remission (partial)	Sub-diabetic hyperglycemia (HbA1c 6%-6.4%, FBG 100-125 mg/dL) In the absence antidiabetic medications
Improvement	Statistically significant reduction in Hb1Ac and FBG not meeting criteria for remission or decrease in anti-diabetic medications requirement (by discontinuing insulin or one oral agent, or ½ reduction in dose)
Unchanged	The absence of remission or improvement as describer earlier
Recurrence	FBG or Hb1Ac in the diabetic range (≥ 126mg/dL and ≥6.5% respectively) Or need for antidiabetic medication after any period of complete or partial remission

TABLE D- DEFINITIONS OF HYPERTENSION OUTCOMES AFTER BARIATRIC SURGERY

Improvement	Defined as a decrease in dosage or number of anti-hypertensive medication or decrease in systolic or diastolic blood pressure (BP) on the same medication (better control)
Partial remission:	Defined as pre-hypertension values (120-140/80-89) when off medication.
Complete remission:	Defined as being normotensive (BP<120/80) off anti-hypertensive medication. If medication such as beta-blockade is used for another indication (arterial fibrillation), this needs to be clearly described but cannot be included as complete remission because of the dual therapeutic effect of some medications.

TABLE E- DEFINITIONS OF HYPERLIPIDEMIA OUTCOMES AFTER BARIATRIC SURGERY

LDL Cholesterol	<100mg/dl=optimal (or <40mg/dl if another risk factor is present) 100-129 mg/dl=near optimal 130-159 mg/dl=borderline high 160-189 mg/dl=high >190 mg/dl= very high
HDL Cholestrol	<40 mg/dl= low >60 mg/dl=high
Total Cholesterol	<200 mg/dl = desirable 200-239 mg/dl – borderline high >240 mg/dl = high
Triglycerides	<150 mg/dl = normal 150-199 mg/dl = borderline high 200-499 mg/dl = high >500 mg/dl = very high

STATISTICAL ANALYSIS

Data were described in terms of range, mean +- standard deviation (+-SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitate variables between the groups was done using paired t-test. A probability value (P value) less than 0.05 was considered statistically significant. All statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

OBSERVATION AND RESULTS

This study was conducted on 86 morbidly obese patients who were admitted to Department of Surgery, DMC&H between Jan 2017 to Feb 2022 and underwent Bariatric surgeries. Patients were evaluated according to age, BMI, HBA1c, HDL, LDL, weight, co-morbid conditions and postoperative complications.

Table 1 – Age wise distribution of patients. (n=86)

AGE	No. of cases	Percentage
< 40	33	38.4%
41-50	21	24.4%
51-60	26	30.2%
> 60	6	7.0%
Total	86	100.0%

Among patients who underwent surgery majority were <40 (38.4%) years of age, followed by patients in 50-60(30.2%) years, 41-50 years (24.4%) and least patients were present in age group >60years (7.0%) years. This is shown in the figure below.

Figure 1 – Age wise distribution of patients. (n=86)

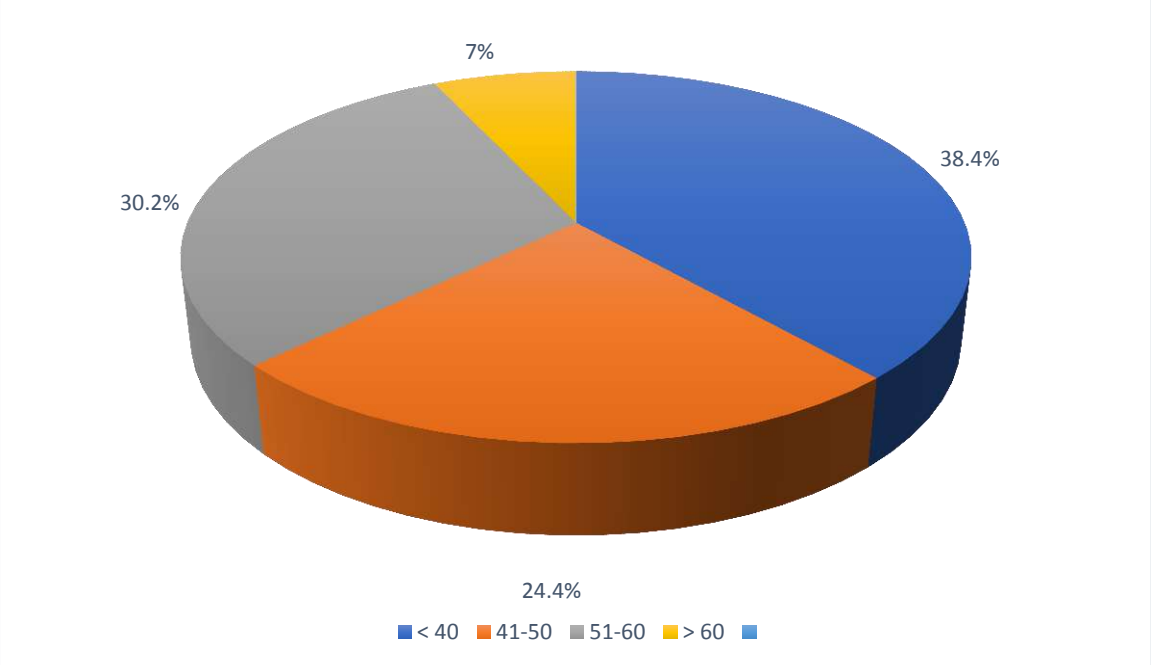


Table 2- Gender wise distribution of patients. (n=86)

GENDER	No. of cases	Percentage
FEMALE	51	59.3%
MALE	35	40.7%
Total	86	100.0%

There was female predilection with the number of 51(59.3%) being females, while 40.7% were male patients. This is depicted in Table 2 and figure 2.

Figure 2- Gender wise distribution of patients. (n=86)

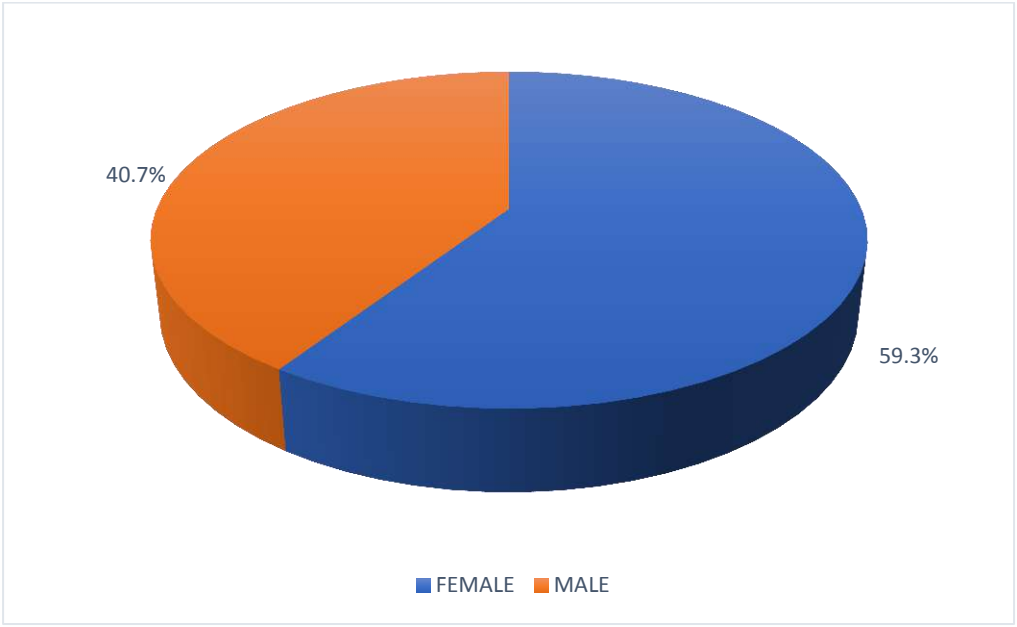


Table 3- Distribution of patients according to comorbidities. (n=86)

DIABETES MELLITUS	64	74.4%
HYPERTENSION	31	36.0%
CAD	3	3.5%
PCOD	2	2.3%
OSA	6	7.0%

In our study, out of 86 patients, Maximum patients in present study had Diabetes mellitus (74.4%) followed by HTN (36%), followed by OSA (7%). followed by CAD (3.5%) , followed by PCOD (2.3%). This is shown in Table 3 and figure 3.

Figure 3- Distribution of patients according to comorbidities. (n=86)

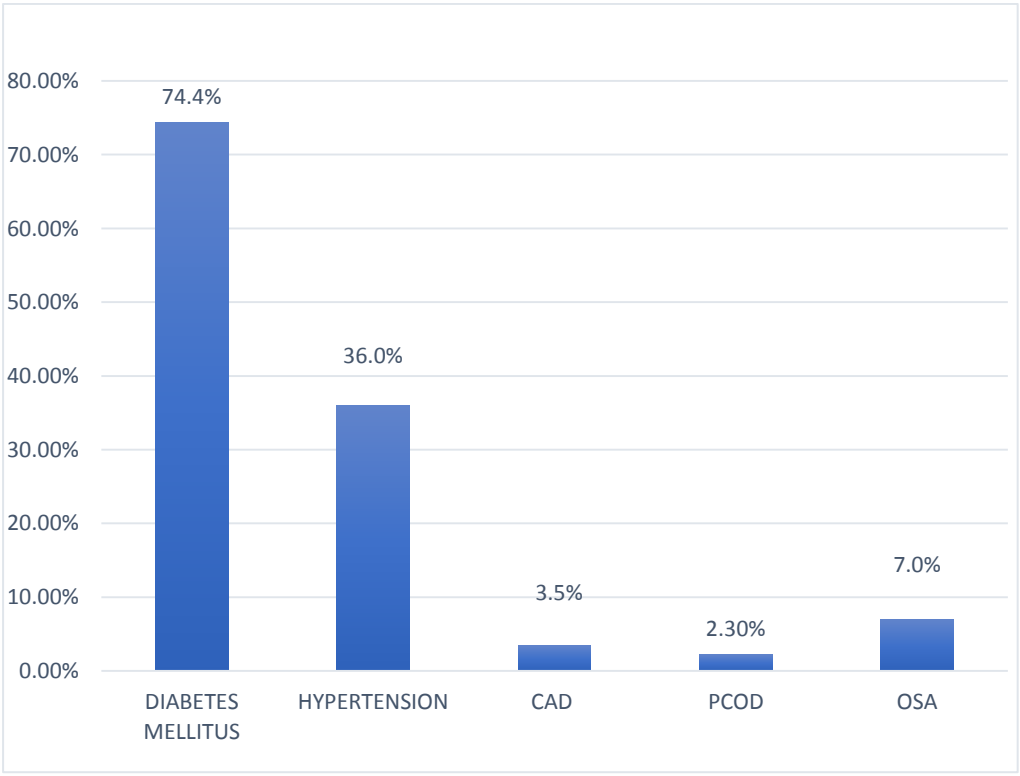


Table 4- Various baseline characteristics preoperatively

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	86	26.0	74.0	46.0	9.7
HBA1C	86	5.2	12.0	7.4	1.3
FBS	86	80.0	282.0	160.1	39.1
HDL	86	22.0	69.0	42.4	10.1
LDL	86	43.0	173.0	113.6	20.9
Weight	86	87.0	172.0	117.6	19.1
BMI	86	35.1	78.7	45.3	7.6
SYSTOLIC BP	86	110.0	150.0	126.3	9.6
DIASYSTOLIC BP	86	60.0	90.0	77.8	7.9

Above table shows baseline characteristic of various variables assessed in the study population. In this study of 86 subjects, youngest subject to underwent Bariatric surgery is 26.0 year of age and eldest is 74 years of age with mean Age (46±9.7).

In this study, the mean HBA1c of study group was 7.4±1.3 with minimum 5.2 and maximum of 12.0.

In our study, Mean Fasting blood sugar was 160.1±39.1.

In this study of 86 subjects, Mean HDL levels were 42.4±10.3 and mean LDL levels were 113.6±20.9.

The mean weight of subjects was 117.6±19.1.

Mean BMI of study subjects was 45.3±7.6 with minimum BMI 35.1 and maximum was 78.7.

The mean Systolic blood pressure was 126.3±9.6 and mean Diastolic blood pressure was 77.8±7.9.

Table 5- Distribution of surgeries done in study population.

SURGERIES	No. of cases	Percentage
LPG-SG	30	34.9%
MGB	15	17.4%
RYGB	19	22.1%
SG	22	25.6%
Total	86	100.0%

Out of 86 subjects studied, 30 (34.9%) underwent LPG-SG, 22 (25.6%) underwent SG, 19(22.1%) RYGB and 15(17.4%) underwent MGB. This is shown in Table 5 and figure 4.

Figure 4- Distribution of surgeries done in study population

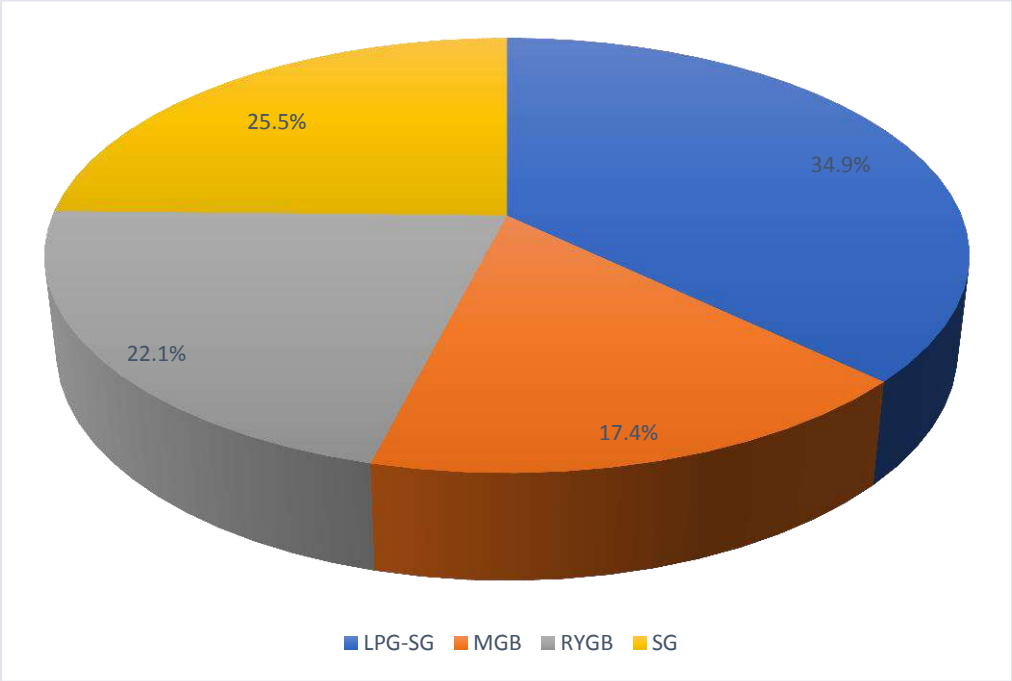


Table 6– Comparison of weight at different time intervals.

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE WEIGHT	117.6	19.1				
0M	117.6	19.1				
1M	107.6	16.8	17.830	0.001	10.0	5.2
3M	96.0	14.3	25.216	0.001	21.6	8.0
6M	86.8	11.7	22.594	0.001	30.8	12.7
12M	80.8	9.7	24.287	0.001	36.8	14.0

As regards the Co-morbidities, significant reduction in weight was observed in all the patients after surgery. On comparing weight of the patients preoperatively (117.6±19.1) and at 1 month, 3 month, 6 month and 12 month, it was observed that the weight of the person was significantly less at 1 month (107.6±16.8), 3 month (96.0±14.3) , 6 month (86.8±11.7) and 12 month (80.8±9.7). This is depicted in table 6 and figure 5.

Figure 5– Comparison of weight at different time intervals.

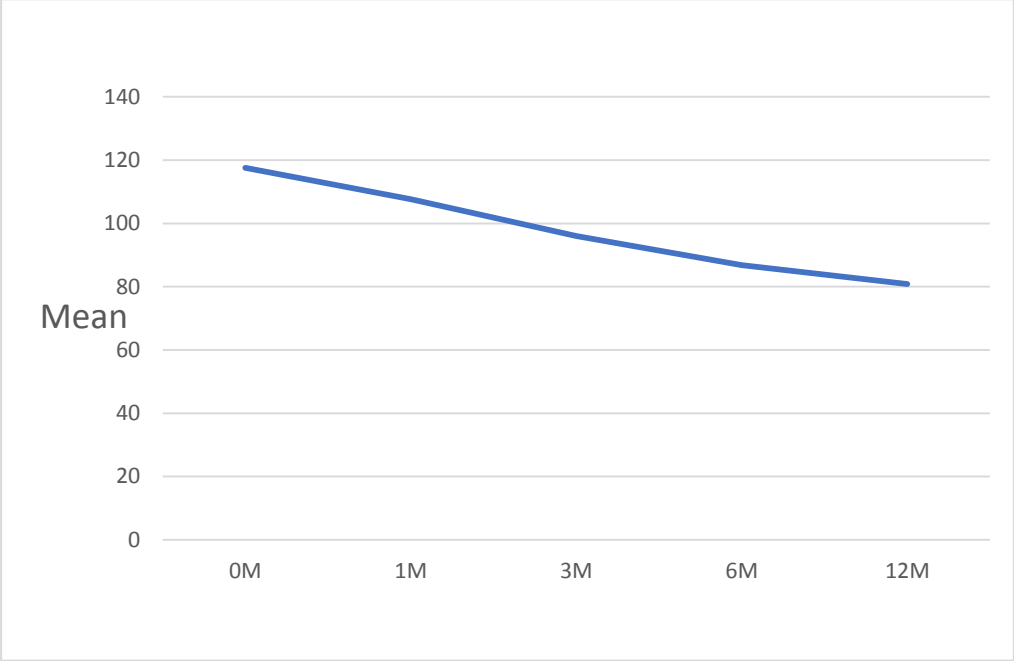


Table 7 – Comparison of Post operative Weight (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE WEIGHT	115.96	17.52	123.09	26.48	117.05	17.12	116.55	17.46
0M	115.96	17.52	123.09	26.48	117.05	17.12	116.55	17.46
1M	106.53	15.82	111.73	22.93	105.63	14.00	107.82	16.11
3M	91.87	13.26	101.73	18.65	97.37	11.15	96.37	14.08
6M	82.40	11.34	91.00	12.49	87.79	7.31	88.96	13.34
12M	77.50	9.78	83.60	9.85	81.26	6.55	83.00	11.12
Diff_1M	9.43	4.57	11.36	5.75	11.42	5.74	8.73	5.06
Diff_3M	24.10	6.85	21.36	9.33	19.68	8.47	20.17	7.59
Diff_6M	33.56	11.21	32.09	16.19	29.26	13.21	27.58	11.19
Diff_12M	38.46	12.31	39.49	19.26	35.79	14.58	33.55	11.79

In our study of 86 subjects, reduction in weight post operatively in different bariatric surgeries were noted (LPG-SG, MGB, RYGB,SG) . Maximum weight loss was noted in postoperative patients of MGB (38.49±19.26) at 12 months followed by LPG-SG(38.46±12.31) at 12 months , RYGB(35.79±14.58) at 12 months and SG(33.55±11.79) at 12 months. This is shown in table 7 and Figure 6.

Figure 6 – Comparison of Post operative Weight (in different procedures)

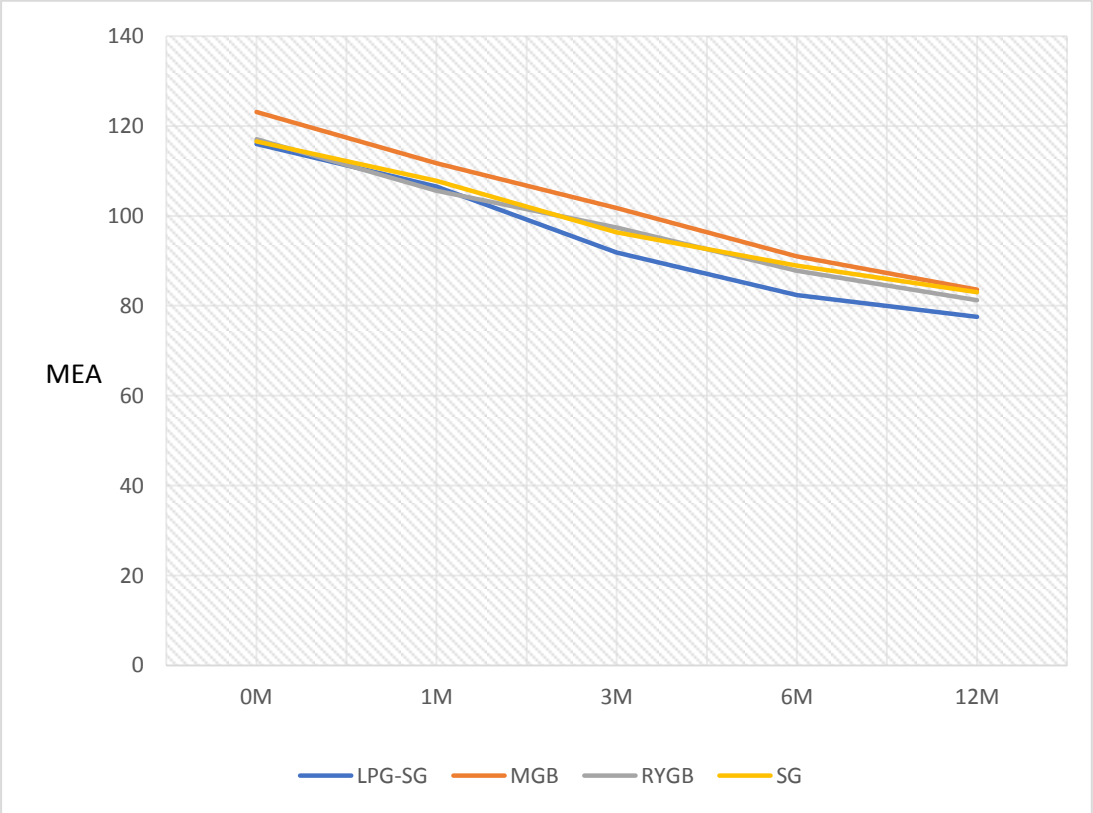


TABLE 8 – Comparison of BMI at different time intervals.

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE BMI	45.3	7.6				
0M	45.3	7.6				
1M	41.6	6.4	14.711	0.001	3.7	2.3
3M	36.5	5.8	26.875	0.001	8.8	3.0
6M	31.9	4.7	23.501	0.001	13.4	5.3
12M	29.0	3.8	24.300	0.001	16.3	6.2

Significant reduction in BMI was noted, from 45.3± 7.6 pre-operatively to 41.6±6.4 after 1 month, 36.5± 5.8 at 3 month, 31.9±4.7 at 6 month and 29.0±3.8 at 12 month(p=0.001). This is shown in Table 8 and Figure 7.

Figure 7 – Comparison of BMI at different time intervals

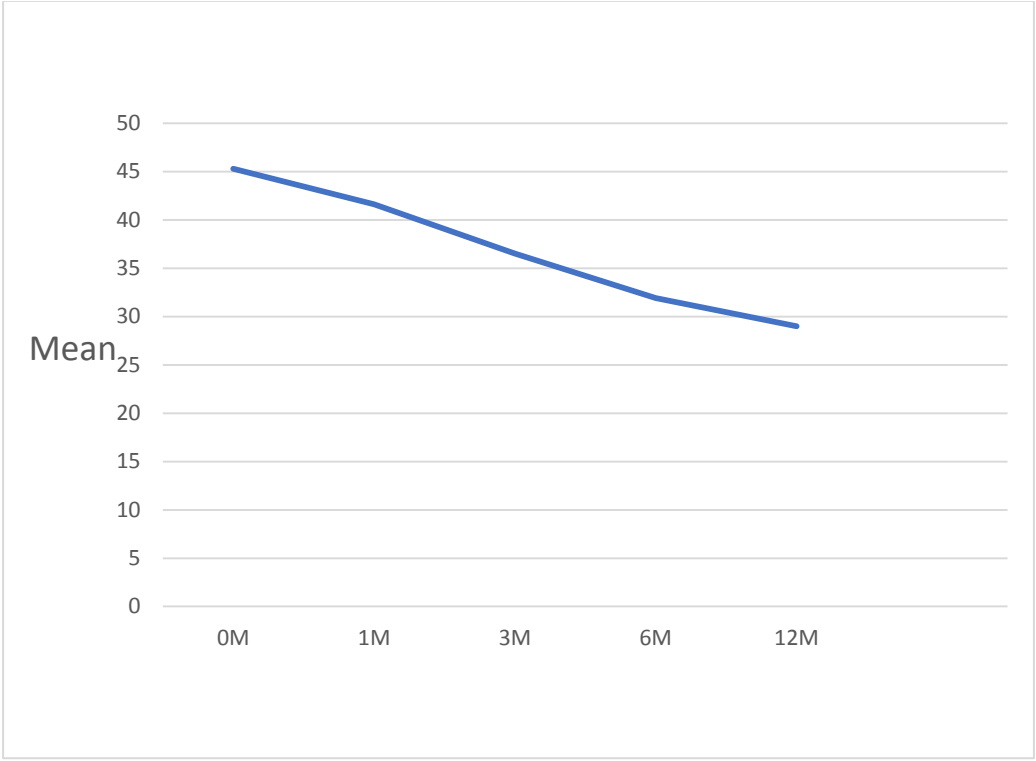


Table 9 – Comparison of Post operative BMI (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE BMI	43.60	6.45	47.45	10.77	46.92	6.75	44.85	6.92
0M	43.60	6.45	47.45	10.77	46.92	6.75	44.85	6.92
1M	40.49	5.65	43.04	9.65	42.34	5.54	41.64	5.66
3M	34.59	5.27	38.52	7.84	37.75	5.53	36.60	4.52
6M	30.19	3.56	32.91	5.59	33.51	5.62	32.31	4.24
12M	28.15	3.61	29.25	3.92	29.86	4.56	29.44	3.05
Diff_1M	3.11	1.50	4.41	3.09	4.58	2.79	3.21	1.97
Diff_3M	9.01	2.42	8.92	3.67	9.18	3.01	8.25	3.50
Diff_6M	13.41	4.95	14.54	6.67	13.42	4.75	12.54	5.34
Diff_12M	15.45	5.20	18.20	8.42	17.06	5.66	15.42	6.27

Reduction in BMI post operatively in different bariatric surgeries were noted (LPG-SG, MGB, RYGB) . Maximum decrease in BMI was noted in postoperative patients of MGB(18.2±8.42) at 12 months followed by RYGB(17.06±5.66) at 12 months , followed by LPG-SG(15.45±5.2) at 12 months, and followed by SG (15.42±6.27) . This is depicted in table 9 and figure 8.

FIGURE 8 – Comparison of Post operative BMI (in different procedures)

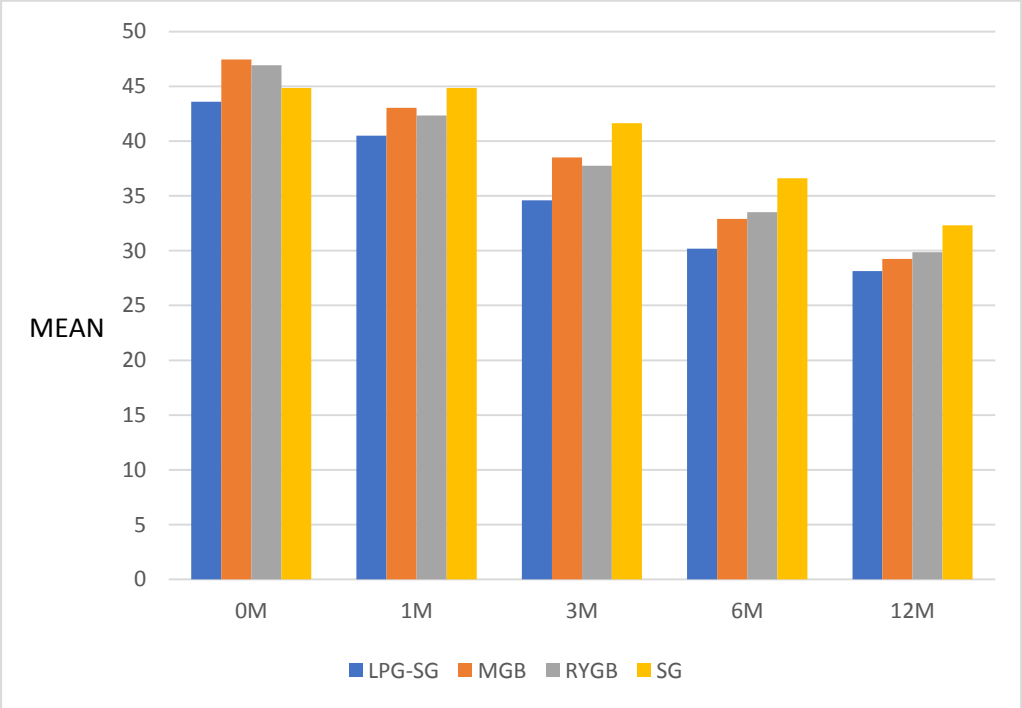


TABLE 10 – Comparison of FBS (fasting blood sugar)

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE FBS						
0M	183.0	51.3	-3.640	0.001	-14.9	38.0
1M	156.0	41.7	3.158	0.002	12.1	35.5
3M	134.7	31.8	10.120	0.001	33.4	30.6
6M	118.6	23.1	15.464	0.001	49.5	29.7
12M	110.2	11.9	16.043	0.001	57.9	33.5

There was significant reduction in FBS from 183.0± 51.3pre-operatively to 156.0±41.7 after 1 month, 134.7± 31.8at 3 month, 118.6±23.1 at 6 month and 110.2±11.9 at 12 month. This is shown in table 10 and figure 9.

Figure 9 – Comparison of FBS (fasting blood sugar)

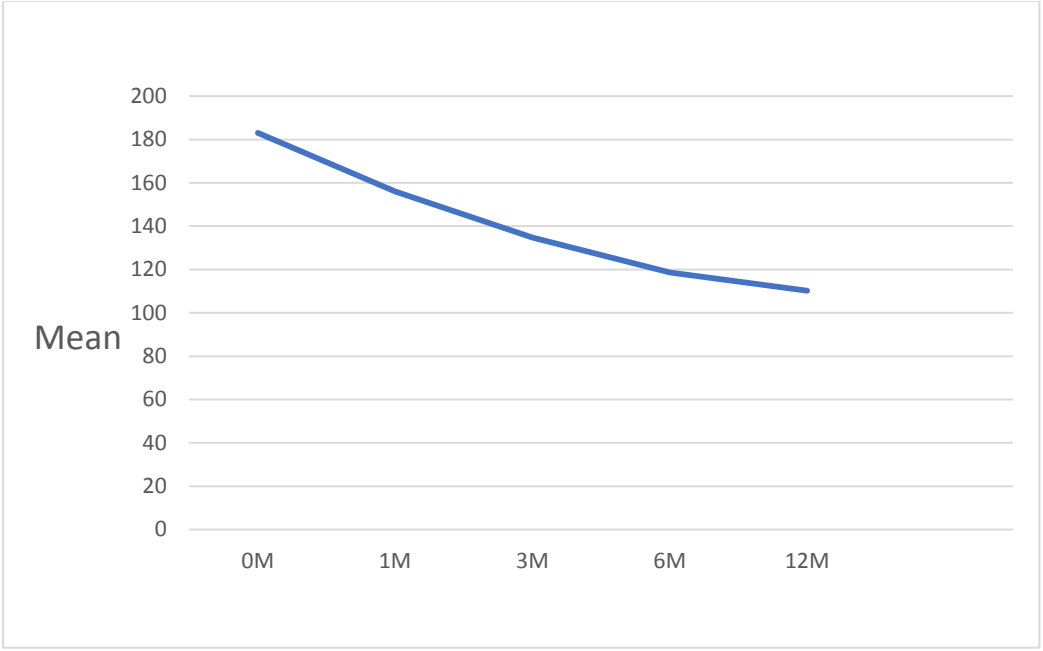


TABLE 11 - Comparison of Post operative FBS (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE FBS	195.67	50.01	166.27	48.42	190.16	44.72	171.09	57.57
0M	195.67	50.01	166.27	48.42	190.16	44.72	171.09	57.57
1M	163.37	42.64	143.33	33.73	164.26	39.86	147.50	45.47
3M	134.47	33.90	125.60	25.29	142.42	26.85	134.45	36.61
6M	119.50	22.36	132.60	19.01	111.68	18.65	113.82	26.93
12M	112.60	13.24	113.27	10.19	105.95	9.77	108.50	12.22
Diff_1M	8.47	40.41	21.13	29.97	9.68	42.70	13.00	24.76
Diff_3M	37.37	31.92	38.87	37.18	31.53	28.98	26.05	25.47
Diff_6M	52.33	16.44	31.87	29.16	62.26	39.12	46.68	30.46
Diff_12M	59.23	27.48	51.20	37.39	68.00	34.95	52.00	36.77

Reduction in FBS was noted with maximum decrease in postoperative patients of RYGB(68.0±34.95) at 12 months followed by LPG-SG(59.23±27.48) at 12 months, SG (52.0±36.7) at 12 months, MGB (51.2±37.39). This is shown in table 11 and figure 10.

FIGURE 10 - Comparison of Post operative FBS (in different procedures)

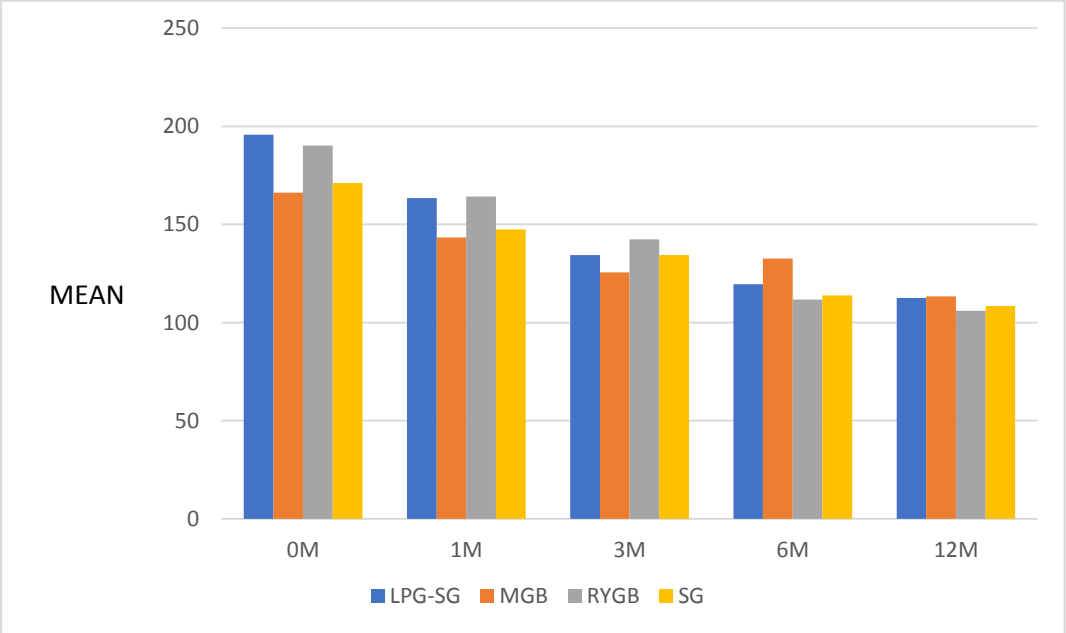


TABLE 12 – Comparison of HBA1c at different time intervals

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE HB1Ac	7.6	1.4				
0M	7.6	1.4				
1M	7.3	1.3	15.350	0.001	0.3	0.2
3M	6.9	1.1	14.654	0.001	0.7	0.5
6M	6.3	0.8	15.644	0.001	1.3	0.8
12M	5.9	0.5	14.617	0.001	1.7	1.1

Significant reduction in HBA1c was noted. There was marked reduction from 7.6 ± 1.4 pre-operatively to 7.3±1.3 after 1 month, 6.9± 1.1at 3 month, 6.3±0.8 at 6 month and 5.9±0.5 at 12 month(P=0.001). This is shown in figure 11 and table 12.

Figure 11 – Comparison of HBA1c at different time intervals

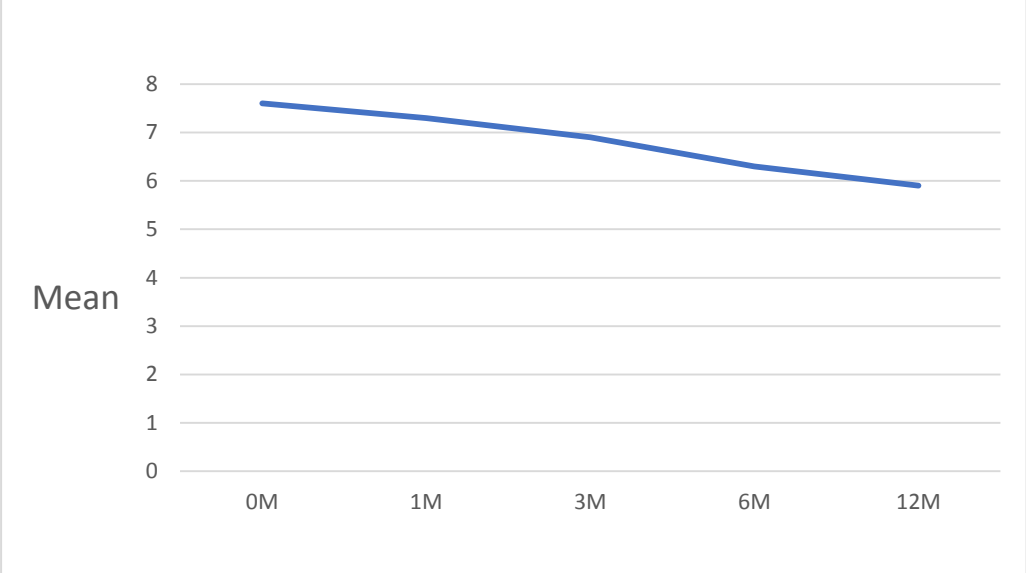


TABLE 13 - Comparison of Post operative HBA1c (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE HB1Ac	7.84	1.28	7.39	1.34	7.58	1.50	7.40	1.37
0M	7.84	1.28	7.39	1.34	7.58	1.50	7.40	1.37
1M	7.53	1.21	7.13	1.17	7.35	1.37	7.12	1.32
3M	6.99	1.03	6.78	1.11	6.90	1.02	6.69	1.12
6M	6.48	0.89	6.00	0.54	6.38	0.91	6.06	0.85
12M	6.01	0.49	5.72	0.34	5.93	0.57	5.67	0.37
Diff_1M	0.31	0.14	0.27	0.21	0.24	0.17	0.29	0.17
Diff_3M	0.85	0.44	0.61	0.39	0.68	0.64	0.72	0.36
Diff_6M	1.36	0.66	1.39	0.94	1.20	0.80	1.35	0.86
Diff_12M	1.83	1.08	1.67	1.15	1.66	1.07	1.73	1.20

Reduction in HBA1c post operatively in different bariatric surgeries were noted (LPG-SG, MGB, RYGB). Maximum decrease in HBA1c was noted in postoperative patients of LPG-SG(1.83±1.08) at 12 months, followed by SG (1.73±1.20) at 12 months, MGB(1.67±1.15) at 12 months, RYGB (1.66±1.07) at 12 months. This is depicted in table 13 and figure 12.

FIGURE 12 - Comparison of Post operative HBA1c (in different procedures)

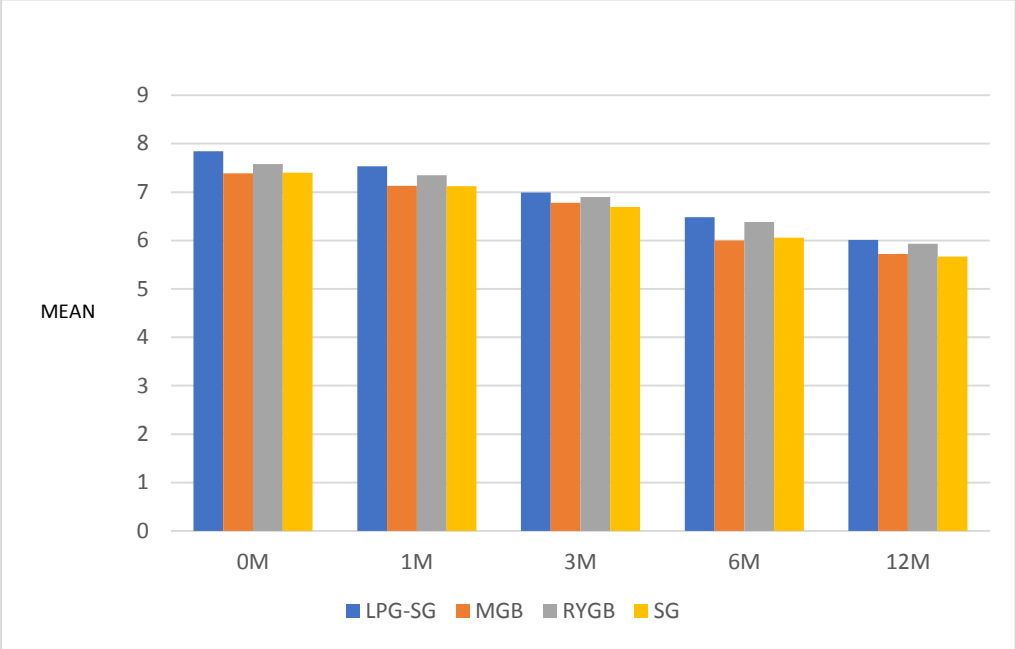


TABLE 14 - Comparison of Systolic blood pressure (SBP)

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE SYSTOLIC BP	126.3	9.6				
0M	126.3	9.6	4.264	0.001	4.1	8.9
1M	122.2	7.7	4.264	0.001	4.1	8.9
3M	124.9	8.8	1.091	0.279	1.4	12.0
6M	124.2	8.3	1.790	0.077	2.1	10.8
12M	124.2	8.3	1.790	0.077	2.1	10.8

Reduction in SBP from 126.3±9.6 pre-operatively to 122.2±7.7 is noted after 1 month, 124.9± 8.3 at 3 month, 124.2± 8.3 at 6 month and 124.2± 8.3 at 12 month. This is shown in figure 13 and table 14.

Figure 13- Comparison of Systolic blood pressure

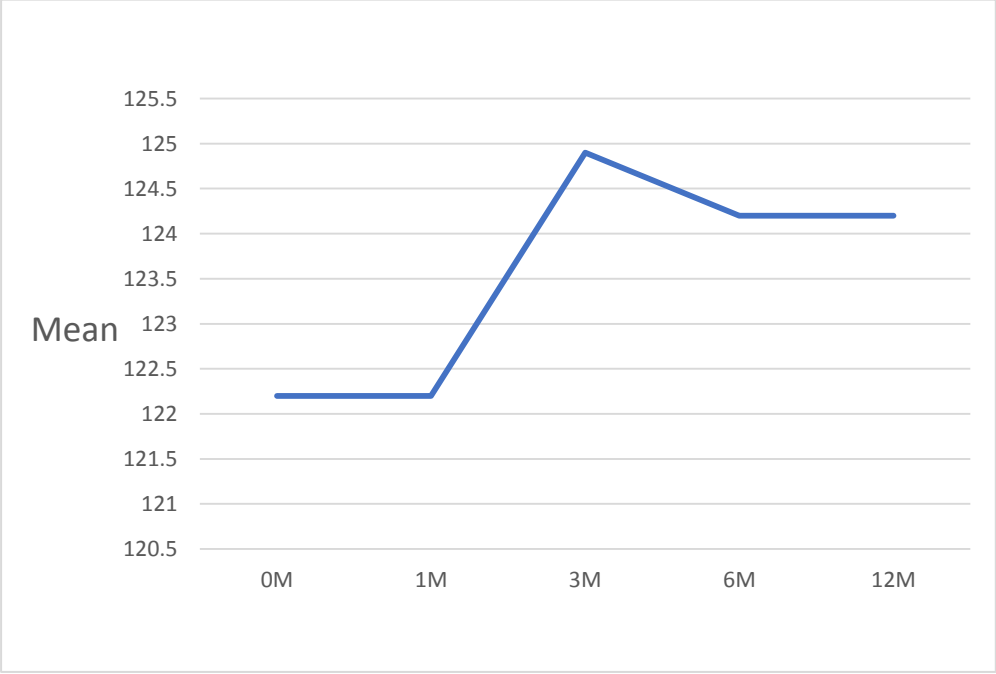


TABLE 15- Comparison of Post operative Systolic Blood Pressure SBP (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE SYSTOLIC BP	126.53	11.25	129.47	8.70	124.74	7.72	125.27	9.19
0M	121.07	6.12	126.47	9.60	120.63	6.00	122.36	8.82
1M	121.07	6.12	126.47	9.60	120.63	6.00	122.36	8.82
3M	121.37	7.94	126.93	9.16	127.05	7.13	126.55	10.13
6M	121.07	6.12	126.53	6.99	125.89	8.81	125.59	10.37
12M	121.07	6.12	126.53	6.99	125.89	8.81	125.59	10.37
Diff_1M	5.47	12.41	3.00	6.86	4.11	6.98	2.91	5.31
Diff_3M	5.17	14.38	2.53	9.58	-2.32	9.71	-1.27	10.52
Diff_6M	5.47	12.41	2.93	10.00	-1.16	9.92	-0.32	8.63
Diff_12M	5.47	12.41	2.93	10.00	-1.16	9.92	-0.32	8.63

Maximum reduction in SBP was noted in postoperative patients of LPG-SG (5.47±12.41) followed by MGB (2.93±8.63) at 12 months, This is depicted in table 15 and figure 14.

FIGURE 14- Comparison of Post operative Systolic Blood Pressure (in different procedures)

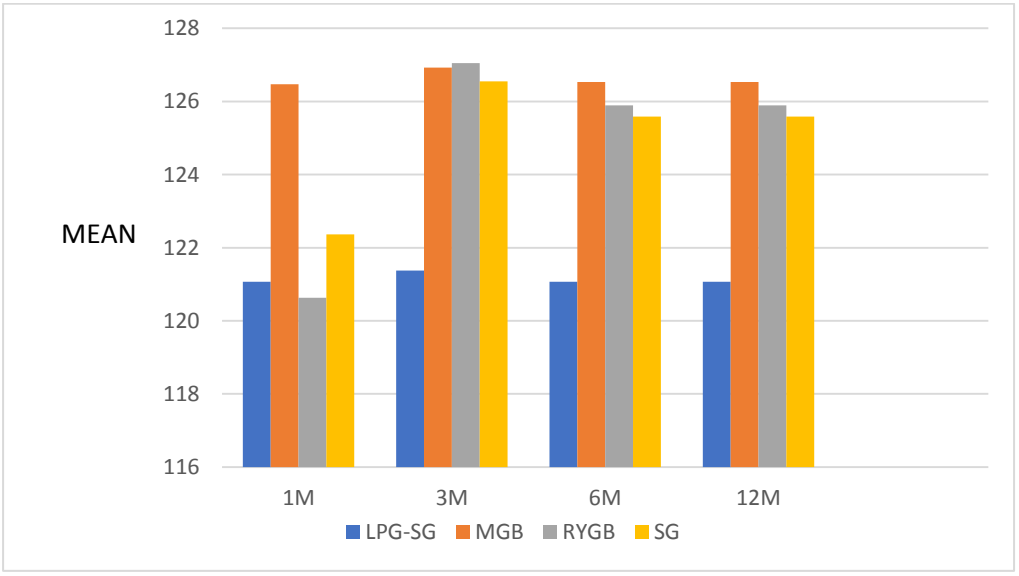


Table 16 – Comparison of Diastolic Blood Pressure (DBP)

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE DIASTOLIC BP						
0M	79.9	7.6	-2.698	0.008	-2.1	7.3
1M	79.9	7.6	-2.698	0.008	-2.1	7.3
3M	79.1	7.7	-1.245	0.217	-1.3	10.0
6M	79.3	7.4	-1.628	0.107	-1.5	8.5
12M	79.3	7.4	-1.628	0.107	-1.5	8.5

Changes in DBP is shown in Table 16 above and Figure 15 below.

Figure 15 – Comparison of Diastolic Blood Pressure (DBP)

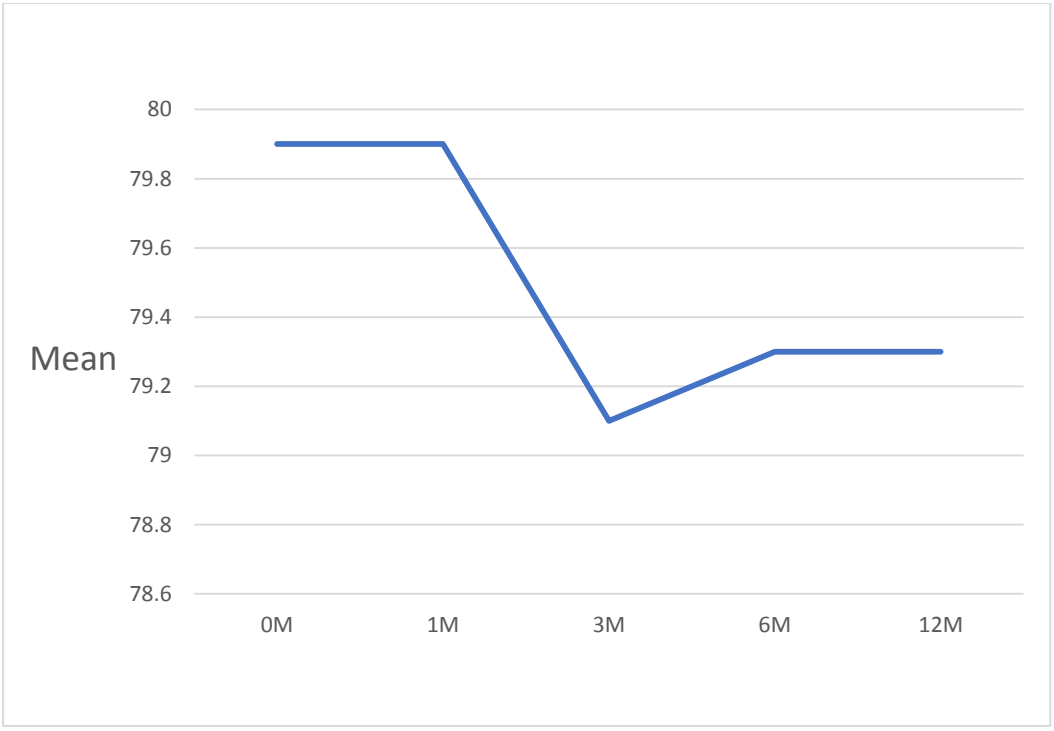


TABLE 17 - Comparison of Post operative Diastolic blood pressure DBP (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE DIASTOLIC BP	81.67	6.99	76.93	7.44	72.63	7.33	77.45	7.36
0M	81.93	6.27	79.47	7.91	76.63	8.54	80.23	7.57
1M	81.93	6.27	79.47	7.91	76.63	8.54	80.23	7.57
3M	79.93	7.73	76.67	7.24	78.21	8.72	80.45	7.22
6M	81.93	6.27	75.87	7.11	76.32	7.61	80.50	7.62
12M	81.93	6.27	75.87	7.11	76.32	7.61	80.50	7.62
Diff_1M	-0.27	7.77	-2.53	5.78	-4.00	7.54	-2.77	7.32
Diff_3M	1.73	12.24	0.27	7.63	-5.58	9.99	-3.00	6.55
Diff_6M	-0.27	7.77	1.07	9.35	-3.68	9.55	-3.05	7.87
Diff_12M	-0.27	7.77	1.07	9.35	-3.68	9.55	-3.05	7.87

Among 86 subjects of study , reduction in DBP was noted post operatively. Decrease in DBP was noted in postoperative patients of MGB (1.07±9.35). This is shown in Table 17 above and Figure 16 below.

Figure 16- Comparison of Post operative Diastolic blood pressure (in different procedures)

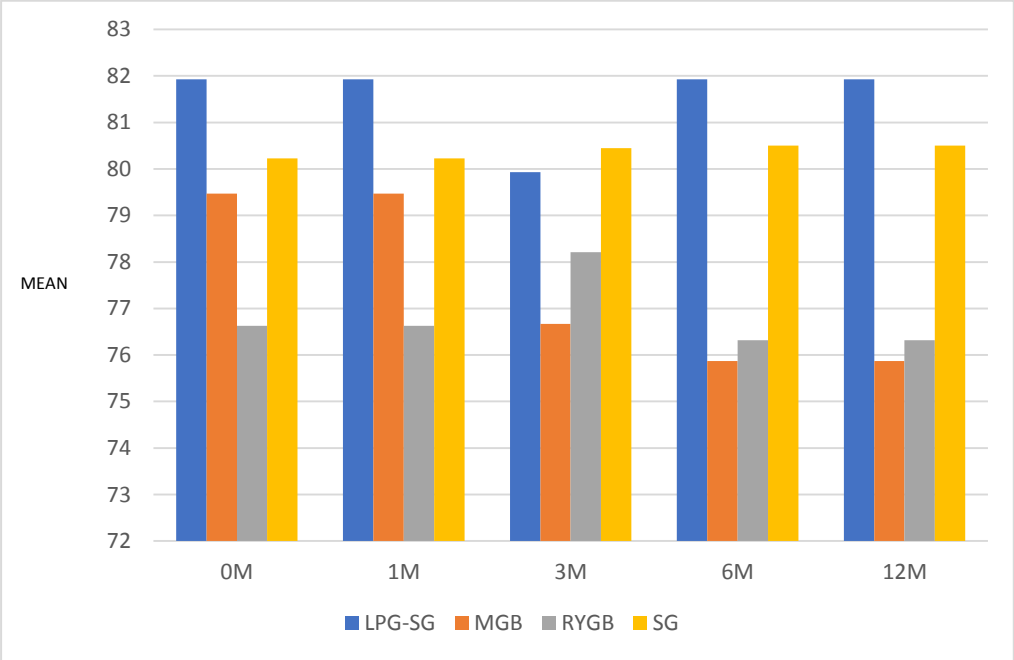


Table 18 – Comparison of HDL levels (High density Lipoproteins)

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE HDL	42.4	10.1				
0M	42.4	10.1				
1M	45.3	8.1	-5.829	0.001	-2.9	4.6
3M	44.6	8.4	-4.906	0.001	-2.2	4.2
6M	54.4	13.1	-6.898	0.001	-12.0	16.2
12M	68.1	6.8	-18.400	0.001	-25.7	13.0

In our study, it is noted that there is significant increase in HDL is observed in this study (P=0.001). Marked increase from 42.4±10.1 pre-operatively to 45.3±8.1 at 1 month, 44.6±8.4 at 3 month, 54.4±13.1 and 68±6.8 at 12 month. This is shown in table 18 above and figure 17 below.

Figure 17 – Comparison of HDL levels (High density Lipoproteins)

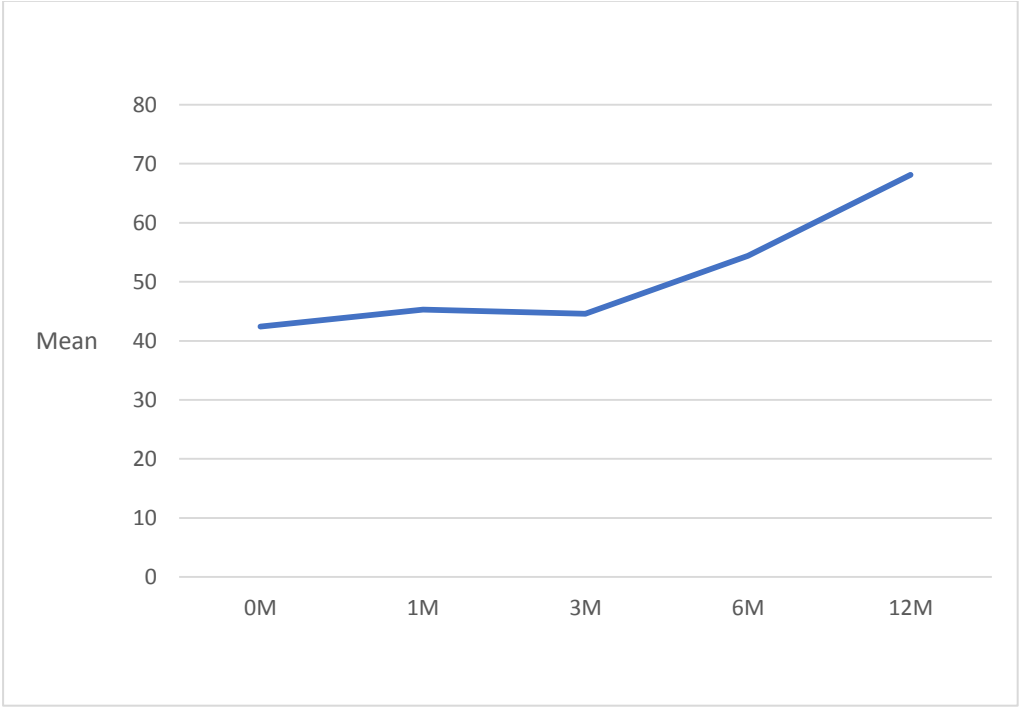


TABLE 19 - Comparison of Post operative HDL Levels (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE HDL	40.63	7.78	44.73	13.94	40.47	9.59	44.82	10.14
0M	40.63	7.78	44.73	13.94	40.47	9.59	44.82	10.14
1M	45.00	6.50	45.33	9.54	42.11	7.05	48.32	9.05
3M	45.00	6.48	45.00	9.60	40.84	8.47	47.14	9.31
6M	60.60	9.50	47.40	14.07	48.74	15.23	55.68	10.69
12M	68.93	7.78	66.87	7.17	68.26	5.30	67.59	6.40
Diff_1M	-4.37	2.57	-0.60	6.60	-1.63	4.11	-3.50	4.89
Diff_3M	-4.37	2.62	-0.27	6.36	-0.37	4.31	-2.32	2.83
Diff_6M	-19.97	11.11	-2.67	21.44	-8.26	16.27	-10.86	13.75
Diff_12M	-28.30	11.63	-22.13	17.04	-27.79	11.56	-22.77	12.34

It has been observed in our study that LPG-SG (28.3±11.63) had maximum increase in HDL levels at 12 months, followed by RYGB (27.79±11.56) at 12 months, followed by SG (22.77±12.34) months at 12 months, followed by MGB (22.13±17.04). This is depicted in Table 19 above and figure 18 below.

FIGURE 18 - Comparison of Post operative HDL Levels (in different procedures)

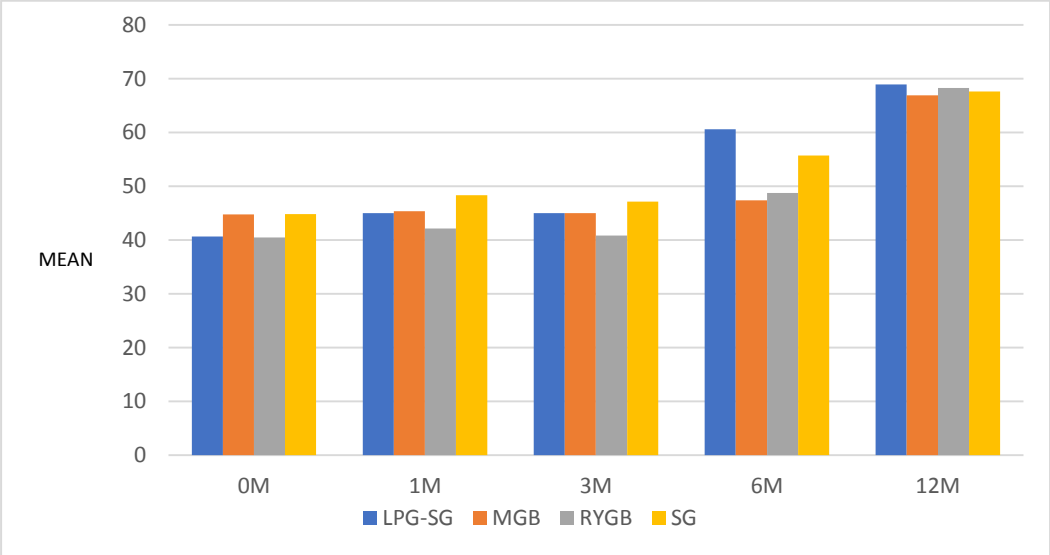


TABLE 20 – Comparison of LDL Levels (Low Density lipoproteins)

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE LDL	113.6	20.9				
0M	113.6	20.9				
1M	101.5	3.0	1.421	0.250	3.3	4.6
3M	102.7	20.1	13.778	0.001	10.9	7.3
6M	90.7	22.8	11.879	0.001	22.9	17.9
12M	78.3	16.1	13.289	0.001	35.3	24.7

In our study, significant decrease in LDL was observed. Marked reduction from 113.6±20.9 pre-operatively to 101.5±3.0 at 1 month, 102.7±20.1 at 3 month, 90.7±22.8 and 78.3±16.1 at 12 month was noted. This is depicted in Table 20 above and Figure 19 below.

Figure 19 – Comparison of LDL Levels (Low Density lipoproteins)

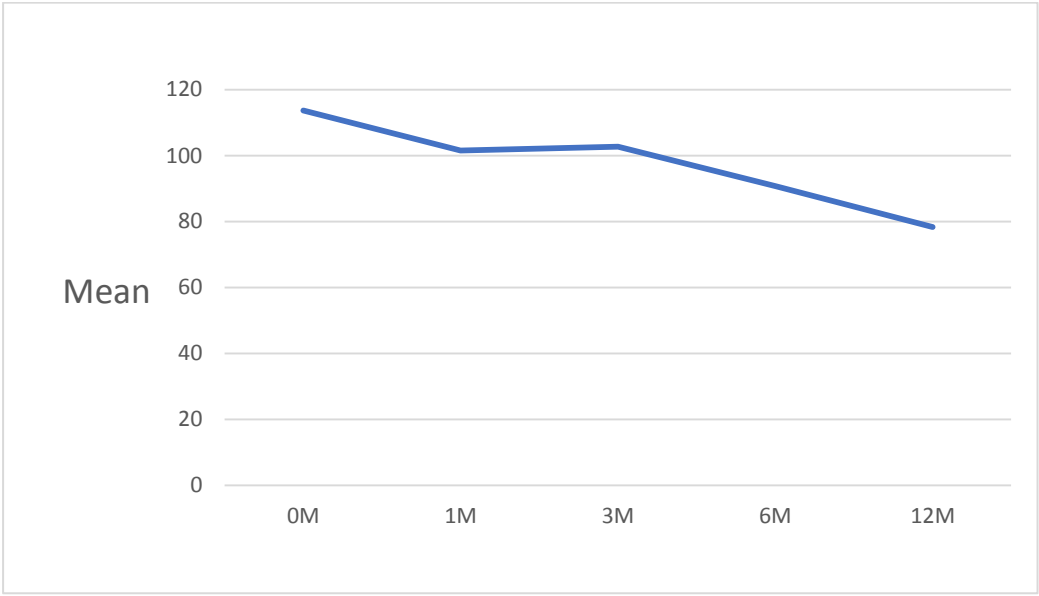


TABLE 21 - Comparison of Post operative LDL Levels (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE LDL	115.37	12.96	109.80	26.63	107.74	27.49	119.00	18.49
0M	115.37	12.96	109.80	26.63	107.74	27.49	119.00	18.49
1M	112.37	12.10	105.93	26.24	102.47	26.16	114.41	17.79
3M	104.70	11.27	99.47	26.08	94.53	23.68	109.32	20.11
6M	98.77	11.32	82.40	28.68	80.58	25.82	94.23	23.52
12M	81.07	13.39	79.27	20.10	76.84	16.09	75.09	16.77
Diff_1M	3.00	2.65	3.87	2.47	5.26	3.09	4.59	3.45
Diff_3M	10.67	5.03	10.33	7.44	13.21	11.06	9.68	5.93
Diff_6M	16.60	9.93	27.40	16.72	27.16	24.87	24.77	18.72
Diff_12M	34.30	18.98	30.53	31.31	30.89	29.50	43.91	21.28

It has been observed in our study that SG(43.91±21.28) had maximum decrease in LDL levels at 12 months, followed by LPG-SG (34.30±31.31) followed by RYGB(30.89±29.50) at 12 months, followed by MGB(30.53±31.31) months at 12 months. This is shown in Table 21 above and figure 20 below.

FIGURE 20 - Comparison of Post operative LDL Levels (in different procedures)

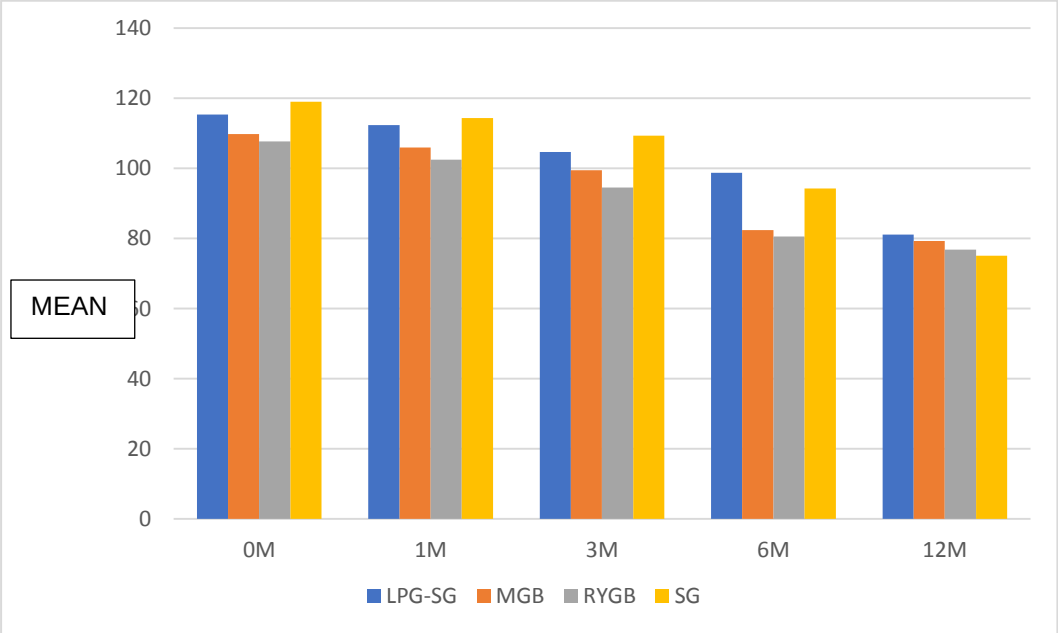


TABLE 22 – Comparison of Serum Calcium levels.

	Mean	SD	t	p-value	Mean difference	SD difference
PRE-OPERATIVE Serum CALCIUM Levels	9.1	0.6				
0M	9.1	0.6				
1M	9.1	0.6				
3M	8.8	0.6	5.608	0.001	0.3	0.5
6M	9.1	0.5	1.240	0.218	0.1	0.6
12M	9.1	0.5	1.209	0.230	0.1	0.6

Marked reduction in serum calcium levels was observed at 3 months. This is shown in Table 22 and Figure 21 below.

Figure 21 – Comparison of Serum Calcium levels.

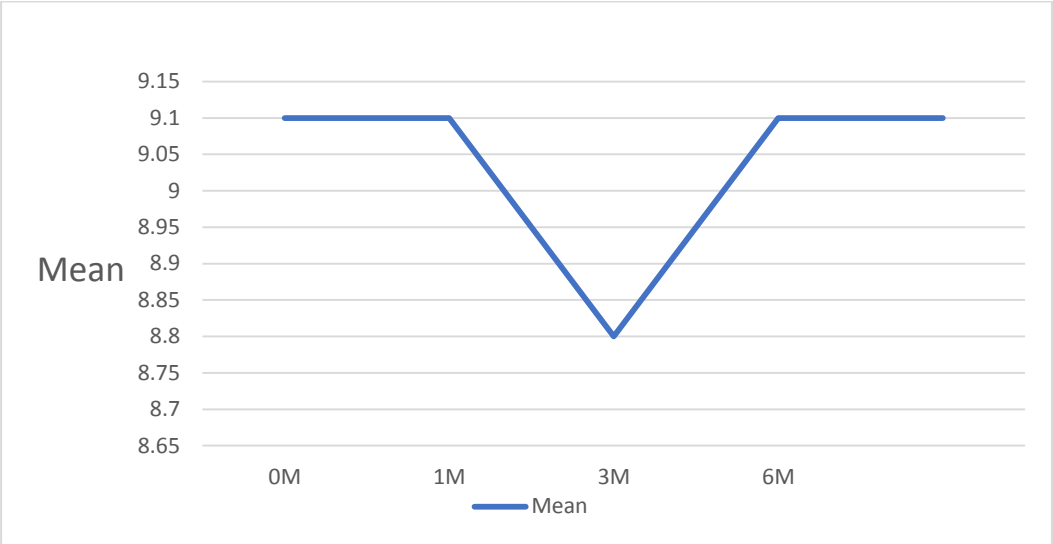


TABLE 23 - Comparison of Post operative Serum Calcium Levels (in different procedures)

	LPG-SG		MGB		RYGB		SG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PRE-OPERATIVE SCA2	9.32	0.52	8.96	0.80	9.15	0.73	9.00	0.50
0M	9.32	0.52	8.96	0.80	9.15	0.73	9.00	0.50
1M	9.32	0.52	8.96	0.80	9.15	0.73	9.00	0.50
3M	8.98	0.47	8.75	0.52	8.75	0.64	8.77	0.62
6M	9.03	0.50	9.11	0.28	9.13	0.47	9.00	0.49
12M	9.03	0.50	9.11	0.28	9.13	0.47	9.01	0.48
Diff_1M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diff_3M	0.34	0.51	0.21	0.49	0.40	0.62	0.23	0.38
Diff_6M	0.29	0.51	-0.15	0.74	0.02	0.50	0.00	0.60
Diff_12M	0.29	0.51	-0.15	0.74	0.02	0.50	-0.01	0.58

In our study , of 86 subjects, post operative difference in serum calcium levels were noted and was found that at 3 months there is fall in serum calcium levels (maximum fall was noted in RYGB, followed by LPG-SG , followed by SG, followed by MGB) for which oral calcium supplementations were started and patient was managed conservatively. This is depicted Table 23 above and Figure 22 below.

FIGURE 22 - Comparison of Post operative Serum Calcium Levels (in different procedures)

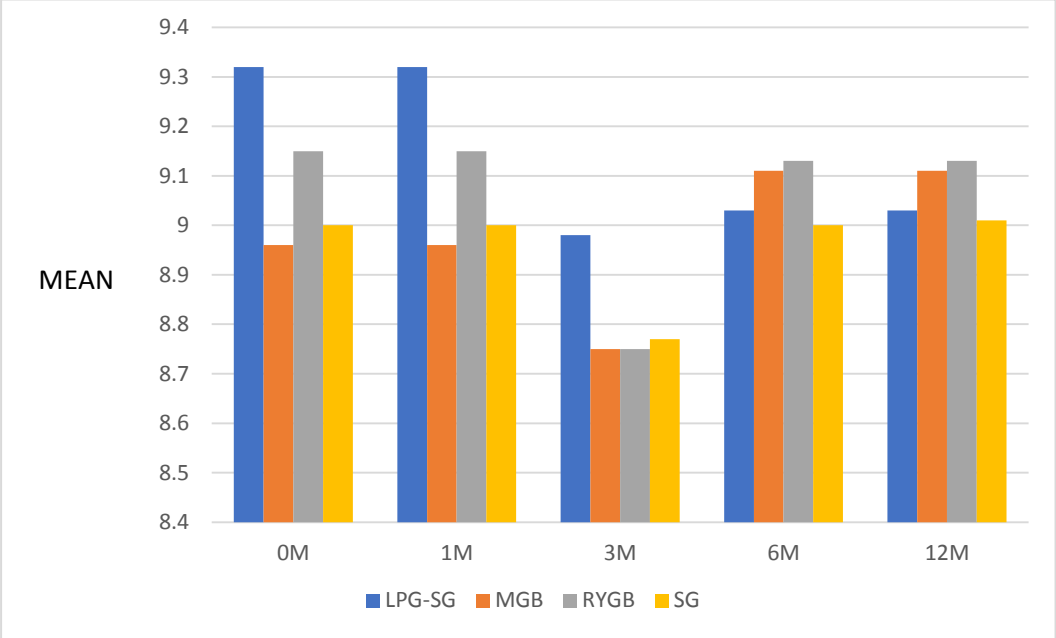


TABLE 24 - POST-OP COMPLICATIONS

	No. of cases	Percentage
EARLY EPISODES OF NAUSEA AND VOMITING	37	43.0%
SURGICAL SITE INFECTION	2	2.3%
DIARRHOEA	17	19.8%
VIT B12 MALNUTRITION	2	2.3%
GERD	9	10.5%

There was no major post-operative complication observed in any patient until 12 months. Early episodes of nausea and vomiting were most common complications noted in 37(43.0%) followed by diarrhoea 17(19.8%), which were managed conservatively. Out of total, 9(10.5%) patients had GERD, 2(2.3%) had vitamin-b 12 malnutrition and 2(2.3%) had SSI. All the complications were managed conservatively without the need of any surgical intervention. This is shown in Table 24 above and Figure 23 below.

FIGURE 23 - POST-OP COMPLICATIONS

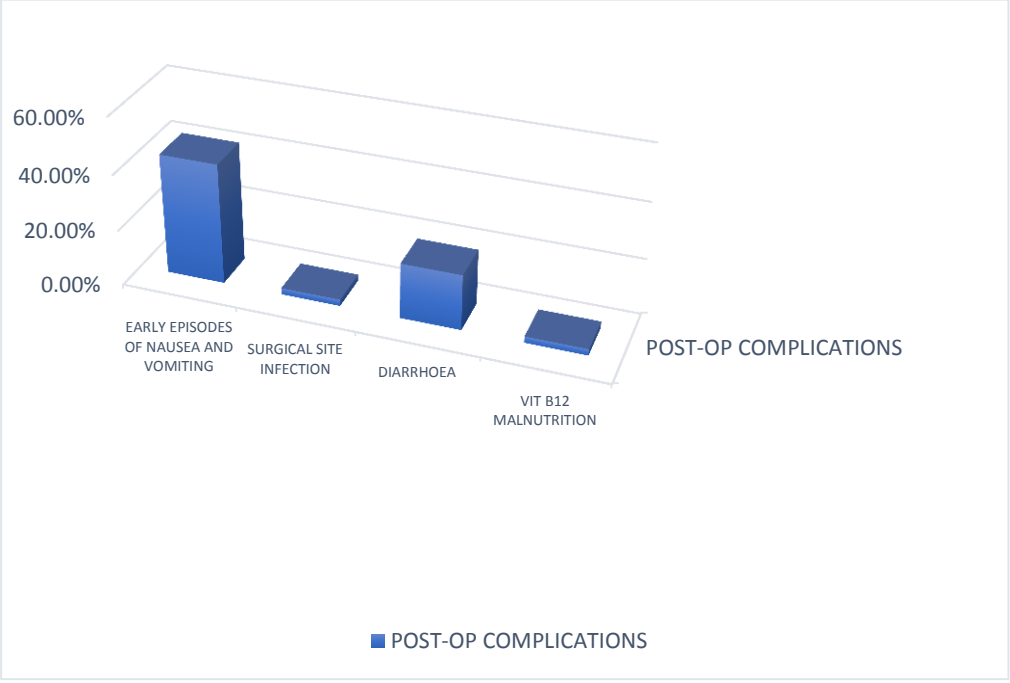


TABLE 25 - Comparison of Post operative complications (in different procedures)

		LPG-SG		MGB		RYGB		SG		Total
		No. of cases	%age	No. of cases	%age	No. of cases	%age	No. of cases	%age	
EARLY EPISODES OF NAUSEA AND VOMITING	NO	17	56.7%	10	66.7%	11	57.9%	11	50.0%	49
	YES	13	43.3%	5	33.3%	8	42.1%	11	50.0%	37
INFECTION	NO	30	100.0%	15	100.0%	17	89.5%	22	100.0%	84
	YES	0	0.0%	0	0.0%	2	10.5%	0	0.0%	2
SHOCK	NO	30	100.0%	15	100.0%	19	100.0%	22	100.0%	86
DIARRHOEA	NO	24	80.0%	10	66.7%	16	84.2%	19	86.4%	69
	YES	6	20.0%	5	33.3%	3	15.8%	3	13.6%	17
ANASTMOTIC LEAK	NO	30	100.0%	15	100.0%	19	100.0%	22	100.0%	86
BOWEL OBSTRUCTION	NO	30	100.0%	15	100.0%	19	100.0%	22	100.0%	86
INCISIONAL HERNIA	NO	30	100.0%	15	100.0%	19	100.0%	22	100.0%	86
VIT B12	NO	29	96.7%	14	93.3%	19	100.0%	22	100.0%	84

MALNUTRITION	YES	1	3.3%	1	6.7%	0	0.0%	0	0.0%	2
GASTRO JEJUNAL STENOSIS	NO	30	100.0%	15	100.0%	19	100.0%	22	100.0%	86
GERD	NO	24	80.0%	14	93.3%	19	100.0%	20	90.9%	77
	YES	6	20.0%	1	6.7%	0	0.0%	2	9.1%	9
GI BLEED	NO	30	100.0%	15	100.0%	19	100.0%	22	100.0%	86
GASTRIC FISTULA	NO	30	100.0%	15	100.0%	19	100.0%	22	100.0%	86
Total		30	100.0%	15	100.0%	19	100.0%	22	100.0%	86

It has been observed in our study, that SG (50%) has maximum rates of post-operative nausea and vomiting, followed by LPSG (43.2%), followed by RYGB (42.1%), followed by MGB (33%)

Post operative infection was seen in 10.5% post-operative patients of RYGB.

For post operative diarrhea, MGB (33.3%) has max cases, followed by LPG-SG (20%) , followed by RYGB (15.8%), followed by SG (13.6%)

For post operative Vit b12 deficiency, MGB (6.7%) has maximum rates, followed by LPG-SG (3.3%) for which vit b12 supplementations were started.

For post operative GERD, LPG-SG has maximum rates of 20%, followed by SG (9.1%) and MGB (6.7%).

In our study no cases of anastomotic leak, bowel obstruction, gastro-jejunal stenosis, gastric fistula were seen.

This is depicted in Table 25.

DISCUSSION

Obesity prevalence continues to rise and has become the most significant disease affecting health care worldwide with multiple chronic diseases associated with obesity, including diabetes, non-alcoholic fatty liver disease, dyslipidaemia, and hypertension. Certain lifestyle interventions like diet, exercise have failed with time. Moreover, isolated pharmacologic therapies targeting body weight regulation have insufficient effect sizes. Bariatric surgery is the only effective therapy that leads to marked and sustained body weight loss with benefits on associated chronic medical conditions.

This study was conducted in Dayanand Medical College and Hospital, Ludhiana, in which 86 morbidly obese patients were enrolled according to the inclusion criteria. Weight, BMI, Fasting blood sugar,HBA1c, SBP, DBP, serum calcium lipid profile and post-operative complications were monitored and documented pre-operatively, after day 1, 3 months, 6 months and 12 months of surgery.

In the present study of 86 patients, maximum patients who underwent surgery were <40 (38.4%) years of age, followed by patients in 50-60(30.2%) years, 41-50 years (24.4%) and least patients were present in age group >60years (7.0%) years. The mean age of patients was 46.0+_9.7 years. In accordance to present study, Diamantis T et al [42] observed mean age of patients was 45.1 years. Similarly, a study by Ahuja et al.[43] reported the mean age 45.63 ± 11.12 years.

There was female predilection (59.3%) in the study, while 40.7% were male patients. Similarly, in a study by Welbourn et al [44] female predilection(73.7%)was seen. Another study by Diamantis T et al[42], 71.1% patients were females. In a study by Boza C et al[45]A total of 161 LSG were analysed 70.8% were women. In contrast to our study, Tinoco et al [46] male preponderance with 66.7%, while 33.3% patients were females.

Out of 86 subjects in the present study, maximum patients had associated Diabetes mellitus (74.4%) followed by HTN (36.6%), OSA(7.0%),CAD(3.5%) and PCOD(2.3%). In accordance to this, in a study by Pantalone KM et al[47], higher prevalence of type 2 diabetes, pre-diabetes, hypertension and cardiovascular disease noted in obese patients. Also in study by Kearns K et al[48] on chronic diseases associated with obesity noted that the most prevalent chronic conditions associated were lower back pain, hypertension, and raised cholesterol levels. A study by Guh DP et al.[49] in their meta-analysis on obese patients observed that both overweight and obesity were associated with multiple co-morbidities including type II diabetes, cancer and cardiovascular diseases. Tazeen H et al [50] on study on Indo-Asian population reported hypertension, diabetes and a raised serum cholesterol concentration in overweight or obese. Similarly, Mokdad et al.[51] reported that adults with a BMI of 40 kg/m2 or higher had an increased risk of diabetes, hypertension, hyperlipidaemia, asthma, and fair or poor health.

Out of 86 subjects studied, 30(34.9%) underwent LPG-SG, 22(25.6%) SG, 19(22.1%) RYGB and 15(17.4%) underwent MGB. In a study by Howell et al [52] of 208 subjects, Roux-en-Y 97 (46.4%) was the most frequently performed procedure. The second most frequent procedure was the laparoscopic SG performed in 88 (42.3%) patients, GB was performed in 23 (11.1%)

DECREASE IN WEIGHT AND BMI

Success or failure of any weight loss surgery is measured by reduction of weight and BMI. In our study, significant reduction in weight was observed in all the patients after surgery. On comparing weight of the patients preoperatively (117.6±19.1) and at 1 month, 3 month, 6 month and 12 month, it was observed that the weight of the person was significantly less at 1 month (107.6±16.8), 3 month (96.0±14.3) , 6 month (86.8±11.7) and 12 month (80.8±9.7).

Maximum weight loss was noted in postoperative patients of MGB (38.49±19.2) at 12 months followed by LPG-SG(38.46±12.31) at 12 months , followed by RYGB (33.55±11.79) at 12 months and SG(33.55±11.79) at 12 months. In contrast to this study, Kehagias et al[53] reported that weight loss (%EWL) was significantly better after SG (72.9%) than RYGB (65.6%) in the first year of the study. Nguyen et al [31] Out of 250 patients, the mean %EWL was higher in the RYGB group than LAGB group. The mean BMI was higher in the LAGB group than RYGB group (37.3 vs 31.6 kg/m) respectively ($P < .05$).

In our study of 86 subjects, significant reduction in BMI post operatively in different bariatric surgeries were noted (LPG-SG, MGB, RYGB). Maximum decrease in BMI was noted in postoperative patients of MGB (18.2±8.42) at 12 months followed by RYGB (17.06±5.66) at 12 months, followed by LPG-SG (15.45±5.2) at 12 months, and followed by SG (15.42±6.27).

Ahuja et al[43] in their study showed that after 1 year of surgery, the mean percent excess body weight loss was 64.46 ± 19.39, mean weight decreased from 115.83 ± 25.64 kg to 82.21 ± 16.80 kg ($p < 0.05$), BMI decreased from 44.85 ± 9.24 to 31.65 ± 5.98 kg/m2 ($p < 0.05$).

On the other hand, Alexandrou et al[54] in 2017 after 180 consecutive procedures (73 BGYR and 107 GV), observed that patients with BMI between 35 and 55 had similar PEP% in both techniques in the first 12 months. However PEP% after BGYR was significantly higher than GV over the next four years. Thus, the study points out that the safety profiles of operations are similar, but BGYR achieved considerably higher PEP% when compared to long-term GV.

Saminen et al [55] in 2018 showed a greater tendency in weight loss with BGYR, however without statistically significant difference ($p>0.05$). The same result was identified in the non-randomized clinical trial of Leyba et al[56].

A study by Nadalini et al [57] on improvement of quality of life after bariatric surgery noted that The entire sample of 110 patients had a preoperative mean BMI of 45±7 kg/m^2. Surgical treatment included gastric banding (n=34), Roux-en-Y gastric bypass (n=69) and sleeve gastrectomy (n=7). The mean BMI at follow-up of 36 13-months was 33±6 kg/m^2. A significant improvement was observed for all dimensions at follow-up ($p< 0.001$).

EFFECT ON CO-MORBIDITIES- T2DM, HTN, DYSLIPIDEMIA

EFFECT ON T2DM

In different metabolic surgical procedures, different results in the rate of resolution of co-morbidities were seen. According to American Diabetes Association, remission in T2DM is glycated haemoglobin (HBA1c) <6.5% without any medication. Weight loss after surgery has most significant effect on T2DM.

In our study, significant reduction in HBA1c post operatively in different bariatric surgeries was noted. Maximum decrease in HBA1c was noted in postoperative patients of LPG-SG(1.83±1.08) at 12 months, followed by SG (1.73±1.20) at 12 months, MGB(1.67±1.15) at 12 months , RYGB (1.66±1.07) at 12 months. Maximum decrease in FBS was noted in postoperative patients of RYGB (68.0±34.95) at 12 months followed by LPG-SG(59.23±27.48) at 12 months , followed by SG (52.0±36.7) at 12 months, followed by MGB (51.2±37.39). In a study conducted by Wei-Jei Lee et al [35] at 1 year after surgery, the mean HbA1c decreased from 8.8 to 6.2%. Significant improvement in glycaemic control, including 130 (53.1 %) patients with complete remission (HbA1c < 6.0 %), 36 (14.7 %) patients with partial remission (HbA1c < 6.5 %), and 26 (10.6 %) patients with improvement (HbA1c < 7 %).

EFFECT ON BLOOD PRESSURE

In the present study, significant reduction in SBP from 126.3±9.6 pre-operatively to 122.2±7.7 is noted in SBP after 1 month(P=0.001), while reduction of 124.9± 8.3 at 3 month , 124.2± 8.3 at 6 month and 124.2± 8.3 at 12 month. Maximum reduction in SBP was noted in postoperative patients of LPG-SG (5.47±12.41) followed by MGB (2.93±8.63) at 12 months.

Among 86 subjects of study, reduction in DBP was noted post operatively. Decrease in DBP was noted in postoperative patients of MGB (1.07±9.35). Kular et al [58] in a study reported 76% resolution of hypertension in MGB that is equivalent to 74% in LSG.

EFFECT ON LIPID PROFILE

Obesity-associated dyslipidaemia includes elevated TG and LDL cholesterol and decreased HDL and also a leading cause of cardiovascular diseases in obese patients. It has been observed in our study that LPG-SG (28.3±11.63) had maximum increase in HDL levels at 12 months , followed by RYGB (27.79±11.56) at 12 months , followed by SG (22.77±12.34) months at 12 months, followed by MGB (22.13±17.04) from the mean pre-operative value of 42.2±10.1($p<0.001$).

Similar results were noted by Heffron et al [59], in their cohort study, where a statistically significant increase in mean HDL cholesterol was detected 1 year post-operatively($P<0.00001$). In contrast to this, Hady et al [60] and some other studies observed no significant increase in HDL cholesterol serum levels.

Significant decrease in LDL was observed in our study. Marked reduction from 113.6±20.9 pre-operatively to 101.5±3.0 at 1 month, 102.7±20.1 at 3 month , 90.7±22.8 and 78.3±16.1 at 12 month was noted. It has been observed in our study that SG(43.91±21.28) had maximum decrease in LDL levels at 12 months ,followed by LPG-SG

(34.30±31.31) followed by RYGB(30.89±29.50) at 12 months , followed by MGB(30.53±31.31) months at 12 months.

Jamal et al [38] study on resolution of hyperlipidaemia reported similar results with reduction in TC and LDL cholesterol in 248 patients. In the recent study by Zaki MKS [61], there was no statistically significant change in levels of TC and LDL cholesterol($p>0.26$).

EFFECTS ON SERUM CALCIUM LEVELS

Bariatric surgical approaches can cause nutrient deficiencies. After surgery calcium and vitamin D absorption is compromised because of bypassing duodenum and proximal jejunum where normally they are absorbed.

In our study of 86 patients, post-operative difference in serum calcium levels were noted and was found that at 3 months there was a fall in serum calcium levels (maximum fall was noted in RYGB, followed by LPG-SG , followed by SG, followed by MGB) for which oral calcium supplements were started and patients were managed conservatively.

A retrospective analysis done by Shah M [62] of all patients undergoing bariatric surgery at Minnesota on 999 patients. Out of total, 36 patients had serum calcium ≤8.9 mg/dl. Mean serum calcium was 8.1 ± 0.6 mg/dl. The prevalence was 1.9% in the RYGB group, 9.3% in the sleeve gastrectomy (SG) group, and 10% in the BPD-DS group.

Several mechanisms predispose patients undergoing bariatric surgery to severe vitamin D deficiency and osteomalacia. After surgery calcium and vitamin D absorption is compromised because of bypassing duodenum and proximal jejunum where normally they are absorbed. In a study conducted in Sweden, 65% of patients had low serum 25(OH) vitamin D levels and 69% had elevated PTH levels post-operatively. Similar results have been found in other studies despite replacement of vitamin D and calcium.

As a result lifelong calcium and vitamin D supplements are mandatory for these patients is recommended by American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery[63].

POST-OPERATIVE COMPLICATIONS

In the present study, no major complication was observed in any patient until 12 months post-operatively. Early episodes of nausea and vomiting were most common complications noted in 37(43.0%) followed by diarrhoea 17(19.8%), which were managed conservatively. Out of total, 9(10.5%) patients had GERD, 2(2.3%) had vitamin-b 12 malnutrition and 2(2.3%) had SSI. LPSG (43.2%) has maximum rates of post-operative nausea and vomiting. All the complications were managed conservatively without the need of any surgical intervention.

Among all the patients who underwent RYGB (10.3%) had SSI. Patients were managed with oral and i/v antibiotics. No case of SSI was seen after other surgical approaches. In a study by Santo MA[64] of 538 morbidly obese patients who underwent Roux-en-Y gastric bypass surgery were reviewed. Among them 2.6% presented with bleeding, 1.1% with intestinal obstruction, peritoneal infections 3.2%, and 2.2% developed abdominal wall infections.

Thus, bariatric surgery results in marked and long lasting weight loss, improvement in obesity related complications such as diabetes mellitus, hypertension, dyslipidaemia, lipid profile and cardiac dysfunction.

SUMMARY AND CONCLUSION

The present study was done in the Department of Surgery, DMCH, Ludhiana that included 86 morbidly obese patients who underwent different bariatric procedures namely LPG-SG, SG, RYGB, MGB. The observations noted during study are as follows.

- As regarding BMI, significant reduction in BMI was noted in the present study with maximum decrease in BMI in postoperative patients of MGB(18.2±8.42) at 12 months followed by RYGB(17.06±5.66) at 12 months , followed by LPG-SG(15.45±5.2) at 12 months, and followed by SG (15.42±6.27)
- Bariatric surgeries led to significant reductions in FBS and HbA1c levels. RYGB showed the highest reduction in FBS at 12 months (68.0±34.95), followed by LPG-SG (59.23±27.48), SG (52.0±36.7), and MGB (51.2±37.39). LPG-SG led to the most marked reduction in HbA1c at 12 months (1.83±1.08), followed by MGB (1.67±1.15), SG (1.73±1.20), and RYGB (1.66±1.07)..
- As regarding Dyslipidemias, Significant improvement was observed in HDL, LDL levels. Reduction in serum calcium levels was observed at 3 months($p<0.001$). Maximum fall was noted in RYGB for which oral calcium supplementations were started and patient was managed conservatively.
- No major complications were observed post-surgery. Nausea, vomiting, diarrhea, and infections were the most common complications, and were managed conservatively. SG had the highest rate of post-operative nausea and vomiting, while RYGB had the highest rate of post-operative infections. MGB had the highest rate of post-operative diarrhea and vitamin B12 deficiency, while LPG-SG had the highest rate of post-operative GERD.
- Hence, we conclude that Bariatric surgeries are excellent modalities for weight loss and improvement of various comorbid conditions like Type 2 Diabetes mellitus, Hypertension, Dyslipidemias, leading to overall improvement in quality of life of morbidly obese patients.

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SR. NO	NAME	AGE	SEX	MRD NO.	PAST HISTORY	PULSE	MEDICAL TREATMENT FOR OBESITY TAKEN (IF ANY)	DIABETES MELLITUS	HBA1C	FBS	HYPERTENSION	CAD	HDL	LDL	PCOD	OSA	ARTHIRITIS
1	JK	45 YRS	FEMALE	617701	HYPOTHYROIDISM & DEPRESSION	80	NO	NO	5.8	100	NO	NO	67	102	NO	NO	NO
2	RK	32 YRS	FEMALE	635050	NO	78	NO	NO	5.9	98	NO	NO	54	113	NO	NO	NO
3	KK	36 YRS	FEMALE	648305	HTN	108	NO	NO	5.8	80	YES	NO	68	102	NO	NO	NO
4	JK	33 YRS	FEMALE	624071	HYPOTHYROIDISM & BRONCHIAL ASTHMA	86	NO	NO	5.3	125	NO	NO	57	102	NO	NO	NO
5	RB	62 YRS	FEMALE	681995	HTN	82	NO	YES	8.1	120	YES	NO	69	98	NO	NO	NO
6	JK	60 YRS	FEMALE	913142	TYPE-II DM	94	NO	YES	8.6	190	NO	NO	38	78	NO	NO	NO
7	AR	52 YRS	FEMALE	704663	NO	96	NO	NO	6.2	122	NO	NO	68	100	NO	NO	NO
8	VR	26 YRS	FEMALE	732278	NO	82	NO	NO	5.8	131	NO	NO	42	73	NO	NO	NO
9	OP	74 YRS	MALE	36331	NO	84	NO	NO	6.3	164	NO	YES	67	43	NO	NO	NO
10	SS	38 YRS	MALE	743901	NO	82	NO	NO	6.3	134	NO	NO	58	171	NO	NO	NO
11	NK	45 YRS	FEMALE	752727	NO	96	NO	NO	5.9	155	NO	NO	36	144	NO	NO	NO
12	HK	54 YRS	FEMALE	760282	NO	82	NO	YES	8	192	NO	NO	47	173	NO	NO	NO
13	JS	35 YRS	MALE	719448	NO	84	NO	NO	5.2	131	NO	NO	44	79	NO	NO	NO
14	SS	43 YRS	MALE	759333	NO	82	NO	NO	5.6	143	NO	NO	39	107	NO	NO	NO
15	HS	44 YRS	FEMALE	182910	NO	96	NO	NO	5.8	188	NO	NO	40	78	NO	NO	NO
16	JP	58 YRS	MALE	812053	NO	82	NO	YES	9.1	190	NO	NO	31	102	NO	NO	NO
17	AG	31 YRS	MALE	505192	TYPE-II DM	84	NO	YES	9.6	225	NO	NO	31	98	NO	NO	NO
18	NQ	40 YRS	FEMALE	851443	NO	88	NO	NO	5.9	147	YES	NO	43	107	NO	NO	NO
19	RS	51 YRS	FEMALE	852433	NO	96	NO	YES	6.9	200	YES	NO	56	83	NO	NO	NO
20	GG	39 YRS	MALE	867708	NO	82	NO	YES	6.5	282	NO	NO	38	73	NO	NO	NO
21	AA	34 YRS	FEMALE	651112	NO	104	NO	NO	6.2	210	NO	NO	30	110	NO	NO	NO
22	IK	51 YRS	FEMALE	900644	TYPE-II DM/ HYPOTHYROIDISM	82	NO	YES	9.2	198	NO	NO	30	100	NO	NO	NO
23	KK	57 YRS	FEMALE	679675	HTN	88	NO	NO	6.2	100	YES	NO	34	80	NO	NO	NO
24	AK	53 YRS	FEMALE	927968	TYPE-II DM	92	NO	YES	8.2	200	NO	NO	40	75	NO	NO	NO
25	RKS	54YRS	FEMALE	434517	DM-2 , HTN	86	YES	YES	8.2	192	YES	NO	43	105	NO	NO	NO
26	SS	38YRS	MALE	497233	DM-2	80	NO	YES	7.3	171	NO	NO	47	103	NO	NO	NO
27	SB	43YRS	MALE	500753	DM-2	95	YES	YES	7	162	NO	NO	41	110	NO	NO	NO
28	MK	44YRS	FEMALE	501956	DM-2	75	YES	YES	6.9	144	NO	NO	43	119	NO	NO	NO
29	D	58YRS	MALE	220398	DM-2 , HTN , OSA	77	NO	NO	7.1	158	YES	NO	48	117	NO	YES	NO
30	KK	39YRS	MALE	217610	DM-2	99	NO	NO	7.5	176	NO	NO	44	160	NO	NO	NO
31	SR	40YRS	FEMALE	301512	DM-2	105	NO	NO	9.9	199	NO	NO	29	91	NO	NO	NO
32	SR	51YRS	FEMALE	501070	DM-2 , HTN	77	NO	YES	8	190	YES	NO	40	100	NO	NO	NO
33	SB	38YRS	MALE	501976	DM-2	74	NO	NO	8.5	201	NO	NO	49	139	NO	NO	NO
34	SD	38YRS	FEMALE	253125	DM-2	82	NO	YES	10	200	NO	NO	48	117	NO	NO	NO
35	SS	40YRS	FEMALE	482434	DM-2	97	NO	YES	6.9	147	NO	NO	45	120	NO	NO	NO
36	GK	51YRS	FEMALE	366101	DM-2 , HTN	100	NO	YES	7.3	176	YES	NO	34	105	NO	NO	NO
37	VT	61YRS	MALE	463161	DM-2 , HTN , OSA	84	YES	YES	7.2	160	YES	NO	42	108	NO	YES	NO
38	MK	53YRS	FEMALE	506167	DM-2 , HTN	93	NO	NO	7	158	YES	NO	26	94	NO	NO	NO
39	PJ	46YRS	FEMALE	512731	DM-2	72	YES	YES	6.9	147	NO	NO	49	120	NO	NO	NO
40	GS	54YRS	MALE	527853	DM-2 , HTN	76	NO	NO	8	195	YES	NO	47	113	NO	NO	NO
41	ET	36YRS	FEMALE	541189	DM-2	80	NO	YES	11	221	NO	NO	38	110	NO	NO	NO
42	BSS	38YRS	MALE	583247	DM-2	79	NO	YES	7.6	152	NO	NO	41	124	NO	NO	NO

SR. NO	NAME	PROCEDURE PERFORMED ON	PROCEDURE NAME	PRE-OPERATIVE WEIGHT	0M	1M	3M	6M	12M	PRE-OPARATIVE BMI	0M	1M	3M	6M	12M
1	JK	05 January 2017	SG	130	130	124	119.6	113.2	101	45.3	45.3	44	40	31.7	28.1
2	RK	18 January 2017	SG	100	100	96	89.6	81	76	37.2	37.2	36.3	35	28.2	27.4
3	KK	13 February 2017	SG	113	113	99	94	88	80	50.2	50.2	46	41.8	39.1	36.2
4	JK	25 February 2017	MGB	170	170	150	140	122	99	58.8	58.8	45	48.4	36.1	32.1
5	RB	04 March 2017	MGB	96	96	89	85	78	72	38.9	38.9	32.1	34.5	28	25
6	JK	25 March 2017	MGB	114	114	106	98	94	83	44.5	44.5	42.2	38.3	36.7	32.1
7	AR	01 April 2017	MGB	98	98	92	84	76	69	39.3	39.3	37	33.6	30.4	27.6
8	VR	25 April 2017	SG	92	92	88	84	80	71	35.9	35.9	34.6	32.8	31.3	27.8
9	OP	09 May 2017	RYGB	108	108	98	92	82	72	45.4	45.4	43.1	37.3	33.3	29.6
10	SS	29 May 2017	MGB	172	172	151	130	100	90	78.7	78.7	72	61	46.9	37.4
11	NK	03 June 2017	SG	94	94	88	81	78	72	41.8	41.8	38.3	35.6	34.7	32.9
12	HK	19 June 2017	RYGB	100	100	88	80	75	69	40.6	40.6	38	35.6	33.3	29.1
13	JS	15 July 2017	RYGB	120	120	100	90	85	85	53.3	53.3	39.7	40	37.8	37.8
14	SS	15 August 2017	RYGB	96	96	88	82	78	72	39.4	39.4	37.2	35.6	34.7	32.6
15	HS	30 August 2017	RYGB	107	107	98	93	89	81	47.6	47.6	44.2	41.3	39.6	35.1
16	JP	01 September 2017	RYGB	123	123	108	105	99	79	54.7	54.7	50.1	46.7	44	34.5
17	AG	16 September 2017	SG	135	135	110	98	86	81	52.7	52.7	45.2	38.3	34.8	31
18	NQ	09 October 2017	MGB	102	102	96	91	85	78	39.8	39.8	37.4	35.5	31.6	29.6
19	RS	26 October 2017	MGB	126.4	126.4	110	100	90	78	49.8	49.8	44.1	39.6	35.6	29.9
20	GG	05 November 2017	RYGB	120	120	106	100	95	81	53.3	53.3	46.1	39.6	37.6	29.9
21	AA	25 November 2017	RYGB	119	119	107	100	92	82	55.8	55.8	52.3	46.9	43.2	37.7
22	IK	26 December 2017	RYGB	120	120	106	101	81	76	53.3	53.3	47.1	44.9	36	27.7
23	KK	01 January 2018	MGB	127	127	110	100	90	81	49.6	49.6	44.1	39.1	35.8	27.6
24	AK	14 February 2018	MGB	115	115	106	100	89	81	43.8	43.8	42.1	38.1	33.9	25.5
25	RKS	01 January 2020	LPG-SG	115	115	110	96	86	78	39.7923	39.7923	38.0622	33.2179	29.7577	25.2
26	SS	01 January 2020	LPG-SG	90	90	85	75	76	71	35.1563	35.1563	33.2031	29.2968	29.6875	27.3
27	SB	01 January 2020	LPG-SG	123	123	118	100	98	82	42.5606	42.5606	40.8304	34.602	33.91	27.3
28	MK	26 February 2018	SG	139	139	130	110	102	91	57.8563	57.8563	54.1103	45.8333	42.4557	34.1
29	D	01 February 2020	LPG-SG	132.9	132.9	127	115	100	89	51.914	51.914	49.6093	44.9218	39.0625	34.9
30	KK	15 March 2018	SG	134	134	130	110	106	96	49.8215	49.8215	48.3343	41.0447	39.411	31.7
31	SR	01 February 2020	LPG-SG	95	95	92	70	68	62	40.0573	40.0573	38.7923	29.5358	28.6726	24.4
32	SR	01 February 2020	LPG-SG	108	108	100	80	78	69	38.2653	38.2653	35.4308	28.3687	27.64	25.6
33	SB	31 March 2018	SG	98	98	94	78	78	75	39.7582	39.7582	38.1354	31.7073	31.64	28.3
34	SD	01 October 2020	LPG-SG	100	100	96	85	85	79	37.8698	37.8698	36.35	32.1969	32.189	29.3
35	SS	07 April 2018	SG	98	98	90	75	70	66	39.7582	39.7582	36.51	30.4878	28.398	25.5
36	GK	01 October 2020	LPG-SG	114	114	105	88	86	86	47.4505	47.4505	43.704	36.6666	35.796	35.79
37	VT	29 April 2018	SG	132	132	125	104	102	91	42.6136	42.6136	40.3538	34.6666	32.928	29.9
38	MK	01 November 2020	LPG-SG	87	87	84	70	70	66	35.2955	35.2955	34.078	28.4552	28.398	24.2
39	PJ	25 May 2018	SG	127	127	115	100	70	68	56.4444	56.4444	51.11	44.4444	31.11	26.6
40	GS	01 November 2020	LPG-SG	120	120	112	95	95	89	37.037	37.037	34.567	29.3209	29.32	27.2
41	ET	25 June 2018	SG	100	100	93	78	78	71	44.4444	44.4444	41.33	34.6666	34.66	28.8
42	BSS	01 December 2020	LPG-SG	146	146	135	110	102	91	43.1238	43.1238	39.87	32.5443	30.127	29.3

SR. NO	NAME	PRE-OPERATIVE HB1Ac	0M	1M	3M	6M	12M	PRE-OPERATIVE FBS	0M	1M	3M	6M	12M	PRE-OPERATIVE SYSTOLIC BP	PRE-OPERATIVE DIASYSTOLIC BP	0M		1M		3M		6M	
1	JK	5.8	5.8	5.6	5.2	5.5	5.6	100	100	90	100	92	110	140	90	140	90	140	90	140	90	140	80
2	RK	5.9	5.9	5.7	5.4	5	5.2	98	98	99	100	100	96	120	70	120	70	120	70	130	70	130	70
3	KK	5.8	5.8	5.8	5.8	5.5	5.1	80	80	86	100	92	110	140	80	140	80	140	80	140	90	140	90
4	JK	5.3	5.3	5.5	5.3	5.2	5.3	125	125	120	92	120	112	130	70	130	70	130	70	130	70	130	70
5	RB	8.1	8.1	7.6	7	6.1	5.8	120	120	116	144	100	106	150	80	150	80	150	80	130	70	130	70
6	JK	8.6	8.6	8.3	7.7	6.5	6	190	190	170	148	117	109	130	80	130	80	130	80	134	80	120	80
7	AR	6.2	6.2	6.1	6.2	6	5.8	122	122	120	120	125	136	130	80	130	80	130	80	130	70	130	70
8	VR	5.8	5.8	5.6	5.2	5.1	5.2	131	131	130	133	134	121	130	76	130	76	130	76	130	70	130	70
9	OP	6.3	6.3	6.2	6.4	5	5.1	164	164	149	150	156	124	120	70	120	70	120	70	130	70	130	70
10	SS	6.3	6.3	6.3	6	5.4	5.3	134	134	134	100	150	110	120	70	120	70	120	70	130	70	130	70
11	NK	5.9	5.9	5.9	5.8	5.1	5.2	155	155	133	132	116	95	130	70	130	70	130	70	130	70	130	70
12	HK	8	8	7.9	7.9	6.6	5.9	192	192	127	149	110	99	130	70	130	70	130	70	130	70	130	70
13	JS	5.2	5.2	5.1	5.3	5.1	5.3	131	131	145	122	100	94	130	70	130	70	130	70	130	70	130	70
14	SS	5.6	5.6	5.6	5.4	5	5.2	143	143	102	126	114	102	120	70	120	70	120	70	130	70	130	70
15	HS	5.8	5.8	5.8	5.8	5.6	5.8	188	188	156	130	92	99	120	70	120	70	120	70	130	70	130	70
16	JP	9.1	9.1	8.9	7.6	6.4	6	190	190	192	136	98	99	120	70	120	70	120	70	130	70	130	70
17	AG	9.6	9.6	9.4	8.2	6.5	6	225	225	172	199	100	106	120	70	120	70	120	70	130	70	130	70
18	NQ	5.9	5.9	5.8	5.4	6	5.9	147	147	100	150	125	104	130	70	130	70	130	70	130	70	130	70
19	RS	6.9	6.9	6.6	5.9	5.9	5.6	200	200	176	164	140	126	120	70	120	70	120	70	130	70	120	70
20	GG	6.5	6.5	6.3	6	6.2	5.5	282	282	198	170	100	124	120	70	120	70	120	70	130	70	120	70
21	AA	6.2	6.2	6.1	6	6.1	5.3	210	210	177	190	124	104	110	60	110	60	110	60	120	70	120	70
22	IK	9.2	9.2	8.9	7.8	6.5	6.1	198	198	226	180	115	110	120	70	120	70	120	70	130	90	120	80
23	KK	6.2	6.2	6.1	6	5.3	5.1	100	100	125	100	120	103	140	90	140	90	140	90	140	90	130	70
24	AK	8.2	8.2	7.9	7.1	6.2	6	200	200	149	99	150	104	122	84	122	84	122	84	130	80	130	80
25	RKS	8.2	8.2	8	7.4	7.1	6.3	192	192	165	150	135	94	140	90	116	80	116	80	120	60	116	80
26	SS	7.3	7.3	6.9	6	5.6	5.1	171	171	142	96	100	127	134	70	124	80	124	80	140	90	124	80
27	SB	7	7	6.6	5.9	5.6	5.3	162	162	135	85	85	120	110	80	119	80	119	80	134	70	119	80
28	MK	6.9	6.9	6.1	6.1	5.3	5.4	144	144	120	72	80	117	110	80	110	76	110	76	110	80	110	76
29	D	7.1	7.1	6.8	6.7	6	5.7	158	158	145	135	90	113	130	90	130	90	130	90	110	80	130	90
30	KK	7.5	7.5	7.1	6.9	6.1	5.8	176	176	136	120	110	104	120	80	110	86	110	86	130	90	110	86
31	SR	9.9	9.9	9.3	8	8.1	6.7	199	260	233	204	145	102	130	70	126	70	126	70	120	80	126	70
32	SR	8	8	7.7	7.4	6.6	6	190	190	170	158	135	100	140	80	130	88	130	88	130	70	130	88
33	SB	8.5	8.5	8	7.8	5.8	5.5	201	201	167	142	158	94	136	80	122	80	122	80	140	80	122	80
34	SD	10	10	9.4	8.9	6.9	5.9	200	280	212	170	144	99	120	80	120	82	120	82	136	80	120	82
35	SS	6.9	6.9	6.5	6.1	5.5	5.6	147	147	129	114	100	103	110	80	114	87	114	87	120	80	114	87
36	GK	7.3	7.3	7.1	6.6	6.2	6	176	176	158	145	104	109	140	90	136	90	136	90	110	80	136	90
37	VT	7.2	7.2	6.9	6.3	6.1	5.3	160	160	150	137	102	105	130	90	130	96	130	96	140	90	130	96
38	MK	7	7	6.8	5.9	6.1	5.8	158	158	148	135	100	124	110	80	121	80	121	80	130	90	121	80
39	PJ	6.9	6.9	6.7	5.7	6	5.5	147	147	140	136	95	104	120	70	120	78	120	78	110	80	120	78
40	GS	8	8	7.7	6.8	6.9	5.7	195	195	180	168	154	126	140	90	126	86	126	86	120	70	126	86
41	ET	11	11	10.6	9.5	7.8	6.1	221	310	276	234	190	138	120	80	120	80	120	80	140	90	120	80
42	BSS	7.6	7.6	7.1	6.9	5	5.2	152	152	126	95	106	102	130	90	122	84	122	84	120	80	122	84

SR. NO	NAME	12M		PRE-OPERARTIVE HDL	0M	1M	3M	6M	12M	PRE-OPERATIVE LDL	0M	1M	3M	6M	12M	PRE-OPERATIVE SCA2	0M	1M	3M	6M	12M	EARLY EPISODES OF NAUSEA AND VOMITING
1	JK	140	80	67	67	65	68	60	72	102	102	98	100	50	48	9.1	9.1	9.1	8.9	8.6	8.9	NO
2	RK	130	70	54	54	53	53	36	60	113	113	104	100	72	66	7.5	7.5	7.5	7.1	8.6	8.6	YES
3	KK	140	90	68	68	67	67	56	61	102	102	104	80	78	46	8.9	8.9	8.9	8.2	8.3	8.3	NO
4	JK	130	70	57	57	57	56	50	66	102	102	100	99	48	52	8.6	8.6	8.6	8.4	8.5	8.5	NO
5	RB	130	70	69	69	65	62	52	63	98	98	92	86	55	53	9.3	9.3	9.3	8.3	9	9	YES
6	JK	120	80	38	38	38	39	38	52	78	78	74	66	60	66	8.9	8.9	8.9	8.9	9.3	9.3	NO
7	AR	130	70	68	68	62	66	30	59	100	100	92	89	60	49	8.3	8.3	8.3	7.9	9.6	9.6	NO
8	VR	130	70	42	42	63	42	38	63	73	73	69	65	51	54	8.9	8.9	8.9	8.3	9.5	9.5	YES
9	OP	130	70	67	67	61	60	42	65	43	43	41	39	40	53	9.1	9.1	9.1	8.2	9.1	9.1	NO
10	SS	130	70	58	58	55	50	55	66	171	171	169	168	138	98	7.6	7.6	7.6	7.7	8.9	8.9	NO
11	NK	130	70	36	36	42	38	38	59	144	144	142	144	52	54	8.1	8.1	8.1	8.3	9.6	9.6	YES
12	HK	130	70	47	47	44	46	39	61	173	173	160	122	61	70	8.4	8.4	8.4	8.2	8.9	8.9	NO
13	JS	130	70	44	44	42	44	34	67	79	79	72	60	48	49	7.6	7.6	7.6	8.1	8.7	8.7	YES
14	SS	130	70	39	39	36	30	31	64	107	107	104	99	53	60	9.3	9.3	9.3	8.6	9.1	9.1	YES
15	HS	130	70	40	40	35	33	35	71	78	78	72	65	56	77	9.6	9.6	9.6	8.9	9.6	9.6	YES
16	JP	130	70	31	31	33	30	30	68	102	102	96	80	69	89	9.8	9.8	9.8	7.6	9.9	9.9	NO
17	AG	130	70	31	31	34	30	31	72	98	98	93	80	74	91	8.9	8.9	8.9	8.2	9.3	9.3	YES
18	NQ	130	70	43	43	42	44	30	69	107	107	101	82	55	102	8.8	8.8	8.8	8.9	8.9	8.9	NO
19	RS	120	70	56	56	41	44	31	63	83	83	81	79	49	69	9.7	9.7	9.7	9.1	9.5	9.5	NO
20	GG	120	70	38	38	42	40	35	59	73	73	70	69	56	89	10.2	10.2	10.2	9.9	9.9	9.9	NO
21	AA	120	70	30	30	36	30	30	77	110	110	104	100	61	60	8.5	8.5	8.5	8.1	8.5	8.5	YES
22	IK	120	80	30	30	38	30	30	76	100	100	90	85	70	106	8.6	8.6	8.6	8.1	9.3	9.3	NO
23	KK	130	70	34	34	39	33	34	65	80	80	76	78	76	119	7.4	7.4	7.4	8.3	8.9	8.9	NO
24	AK	130	80	40	40	40	40	35	79	75	75	77	75	75	98	8.3	8.3	8.3	8.7	9	9	NO
25	RKS	116	80	43	43	46	48	50	60	105	105	98	89	95	98	9.5	9.5	9.5	8.7	9.6	9.6	NO
26	SS	124	80	47	47	50	48	55	65	103	103	104	97	107	109	9.6	9.6	9.6	9.2	9.4	9.4	YES
27	SB	119	80	41	41	45	45	65	70	110	110	106	99	80	83	9.7	9.7	9.7	9.3	9.7	9.7	NO
28	MK	110	76	43	43	45	45	70	76	119	119	118	114	98	85	8.6	8.6	8.6	8.7	8.9	8.9	NO
29	D	130	90	48	48	49	49	50	60	117	117	109	98	90	65	8.3	8.3	8.3	9.1	9.1	9.1	YES
30	KK	110	86	44	44	48	48	55	65	160	160	152	144	130	70	9.2	9.2	9.2	9.4	9.4	9.4	NO
31	SR	126	70	29	29	35	35	50	75	91	91	93	87	85	75	9.1	9.1	9.1	8.9	8.9	8.9	NO
32	SR	130	88	40	40	43	43	63	69	100	100	97	91	89	80	8.9	8.9	8.9	9.1	9.1	9.1	YES
33	SB	122	80	49	49	47	47	55	58	139	139	136	131	125	85	9.1	9.1	9.1	7.9	7.9	7.9	NO
34	SD	120	82	48	48	49	49	55	65	117	117	114	112	100	88	9.6	9.6	9.6	8.9	8.9	8.9	NO
35	SS	114	87	45	45	46	46	60	62	120	120	116	111	100	95	9.6	9.6	9.6	9.1	9.1	9.1	YES
36	GK	136	90	34	34	39	39	59	70	105	105	102	98	105	101	9.6	9.6	9.6	9.3	9.3	9.3	NO
37	VT	130	96	42	42	43	43	63	72	108	108	102	91	100	105	8.9	8.9	8.9	8.7	8.7	8.7	NO
38	MK	121	80	26	26	30	30	70	79	94	94	92	88	70	65	9.2	9.2	9.2	9.3	9.3	9.3	YES
39	PJ	120	78	49	49	50	50	70	78	120	120	119	113	100	66	9.3	9.3	9.3	8.9	8.9	8.9	NO
40	GS	126	86	47	47	49	49	72	77	113	113	109	101	97	60	8.8	8.8	8.8	8.1	8.1	8.1	YES
41	ET	120	80	38	38	42	42	55	60	110	110	106	99	90	61	9.6	9.6	9.6	9.6	9.6	9.6	NO
42	BSS	122	84	41	41	46	46	60	65	124	124	122	117	105	75	9.7	9.7	9.7	9.5	9.5	9.5	YES

SR. NO	NAME	INFECTION	SHOCK	DIARRHOEA	ANASTMOTIC LEAK	BOWEL OBSTRUCTION	INCISIONAL HERNIA	VIT B12 MALNUTRITION	GASTRO JEJUNAL STENOSIS STENOSIS	GERD	GI BLEED	GASTRIC FISTULA
1	JK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2	RK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	KK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4	JK	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
5	RB	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6	JK	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
7	AR	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
8	VR	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
9	OP	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
10	SS	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
11	NK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
12	HK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
13	JS	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
14	SS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
15	HS	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
16	JP	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
17	AG	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
18	NQ	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
19	RS	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
20	GG	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
21	AA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
22	IK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
23	KK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
24	AK	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
25	RKS	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
26	SS	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
27	SB	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
28	MK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
29	D	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
30	KK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
31	SR	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
32	SR	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
33	SB	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
34	SD	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
35	SS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
36	GK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
37	VT	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
38	MK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
39	PJ	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
40	GS	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
41	ET	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
42	BSS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

SR. NO	NAME	AGE	SEX	MRD NO.	PAST HISTORY	PULSE	MEDICAL TREATMENT FOR OBESITY TAKEN (IF ANY)	DIABETES MELLITUS	HBA1C	FBS	HYPERTENSION	CAD	HDL	LDL	PCOD	OSA	ARTHIRITIS
43	NS	36YRS	MALE	768776	DM-2	80	NO	NO	7	144	NO	NO	39	127	NO	NO	NO
44	MK	45YRS	FEMALE	593209	DM-2	82	NO	YES	8.6	197	NO	NO	41	102	NO	NO	NO
45	BS	45YRS	FEMALE	599685	DM-2	110	NO	YES	7.6	172	NO	NO	29	91	NO	NO	NO
46	RK	38YRS	MALE	612196	DM-2	105	YES	YES	7.2	160	NO	NO	48	117	NO	NO	NO
47	MG	74YRS	MALE	647634	DM-2 , HTN , CAD	71	NO	YES	9.5	224	YES	YES	46	98	NO	NO	NO
48	CK	52YRS	FEMALE	23037	DM-2 , HTN	103	NO	YES	12	201	YES	NO	50	105	NO	NO	NO
49	RK	54YRS	FEMALE	31245	DM-2 , HTN	88	YES	YES	7	186	YES	NO	35	115	NO	NO	NO
50	AC	38YRS	MALE	29169	DM-2	98	YES	YES	6.9	177	NO	NO	42	126	NO	NO	NO
51	GS	43YRS	MALE	40167	DM-2	90	NO	YES	7.1	181	NO	NO	45	118	NO	NO	NO
52	RK	44YRS	FEMALE	31820	DM-2	79	NO	YES	6.4	111	NO	NO	22	130	NO	NO	NO
53	CK	58YRS	MALE	16376	DM-2,HTN,OSA	88	NO	YES	6.7	156	YES	NO	30	132	NO	YES	NO
54	IB	39YRS	MALE	26281	DM-2	99	NO	YES	6.2	126	NO	NO	31	120	NO	NO	NO
55	AK	40YRS	FEMALE	25435	DM-2	70	YES	YES	6.9	166	NO	NO	43	121	NO	NO	NO
56	GS	51YRS	FEMALE	32632	DM-2,HTN	77	NO	YES	7.9	123	YES	NO	50	134	NO	NO	NO
57	SB	38YRS	MALE	32824	DM-2	84	YES	YES	8	189	NO	NO	41	112	NO	NO	NO
58	NJ	38YRS	FEMALE	814213	DM-2	95	NO	YES	6.4	133	NO	NO	38	141	NO	NO	NO
59	GB	40YRS	FEMALE	41175	DM-2	100	YES	YES	8.1	172	NO	NO	49	129	NO	NO	NO
60	MA	51YRS	FEMALE	25839	DM-2,HTN	98	NO	YES	6.6	119	YES	NO	41	128	NO	NO	NO
61	S	61YRS	MALE	22206	DM-2,HTN,OSA	83	NO	YES	7.6	199	YES	NO	55	117	NO	YES	NO
62	RT	53YRS	FEMALE	21794	DM-2,HTN	95	NO	YES	9.2	210	YES	NO	37	136	NO	NO	NO
63	PA	46YRS	FEMALE	971787	DM-2	97	NO	YES	9.7	199	NO	NO	38	121	NO	NO	NO
64	HK	54YRS	MALE	980743	DM-2,HTN	104	NO	YES	8.4	181	YES	NO	40	119	NO	NO	NO
65	YG	36YRS	FEMALE	993257	DM-2	105	YES	YES	7.1	158	NO	NO	29	98	NO	NO	NO
66	RM	38YRS	MALE	75165	DM-2	98	YES	YES	7.5	176	NO	NO	40	105	NO	NO	NO
67	PD	36YRS	MALE	8272	DM-2	82	YES	YES	9.9	199	NO	NO	49	115	NO	NO	NO
68	BL	45YRS	FEMALE	30135	DM-2	74	NO	YES	8	190	NO	NO	48	126	NO	NO	NO
69	BB	45YRS	FEMALE	38636	DM-2	82	NO	YES	8.5	201	NO	NO	45	118	NO	NO	NO
70	VG	38YRS	MALE	854079	DM-2	71	NO	YES	10	200	NO	NO	34	130	NO	NO	NO
71	TS	74YRS	MALE	854080	DM-2,HTN,CAD	90	NO	YES	6.9	147	YES	YES	42	132	NO	NO	NO
72	AC	52YRS	FEMALE	704652	DM-2,HTN	98	NO	YES	7.3	176	YES	NO	26	120	NO	NO	NO
73	SK	47YRS	FEMALE	1000138	DM-2,OSA	94	YES	YES	7.2	160	NO	NO	49	121	NO	YES	NO
74	PD	36YRS	FEMALE	1081256	DM-2,PCOD	85	YES	YES	5.9	115	NO	NO	41	115	YES	NO	NO
75	KK	45YRS	FEMALE	1035410	DM-2,HTN	90	YES	YES	6.1	111	YES	NO	29	126	NO	NO	NO
76	SS	45YRS	MALE	1083423	DM-2,HTN,OSA	92	NO	YES	6.6	122	YES	NO	48	118	NO	YES	NO
77	IS	54YRS	MALE	1288193	DM-2,HTN	80	YES	YES	6	90	YES	NO	46	130	NO	NO	NO
78	GK	37YRS	FEMALE	1144044	DM-2,HTN, PCOD	81	NO	YES	6.1	101	YES	NO	50	132	YES	NO	NO
79	NK	52YRS	FEMALE	1205191	DM-2,HTN,HTY	83	NO	YES	5.8	99	YES	NO	35	120	NO	NO	NO
80	NB	45YRS	MALE	1258871	DM-2	85	NO	YES	6.3	111	NO	NO	42	121	NO	NO	NO
81	NK	43YRS	FEMALE	1256585	DM-2,HTN	96	NO	YES	7.1	101	YES	NO	45	134	NO	NO	NO
82	HK	41YRS	MALE	1266325	DM-2,HTN,HTY	99	YES	YES	7.7	129	YES	NO	22	112	NO	NO	NO
83	JS	38YRS	MALE	1263834	DM-2	96	YES	YES	6	104	NO	NO	30	141	NO	NO	NO
84	BB	56YRS	FEMALE	1246764	DM-2,HTN	92	YES	YES	7.3	135	YES	NO	31	129	NO	NO	NO
85	HK	45YRS	FEMALE	1215106	DM-2	91	YES	YES	6.2	97	NO	NO	43	128	NO	NO	NO
86	BK	55YRS	MALE	1286302	DM-2	89	NO	YES	6.9	145	NO	NO	50	117	NO	NO	NO

SR. NO	NAME	PROCEDURE PERFORMED ON	PROCEDURE NAME	PRE-OPERATIVE WEIGHT	0M	1M	3M	6M	12M	PRE-OPARATIVE BMI	0M	1M	3M	6M	12M
43	NS	20 July 2018	SG	144	144	132	115	105	92	39.8891	39.8891	36.565	31.8559	29.0858	27.1
44	MK	01 December 2020	LPG-SG	120	120	110	98	72	68	46.875	46.875	42.9687	38.2812	28.125	26.6
45	BS	01 December 2020	LPG-SG	97	97	89	72	71	68	38.8559	38.8559	35.65	28.9156	28.44	27.3
46	RK	01 January 2021	LPG-SG	105	105	95	90	60	61	55.1354	55.1354	49.8844	47.3684	31.505	31.9
47	MG	15 August 2018	SG	112	112	106	95	89	87	46.0223	46.0223	43.556	39.0946	36.571	36.1
48	CK	01 January 2021	LPG-SG	116	116	110	90	75	71	47.0607	47.0607	44.626	36.5853	30.4271	28.7
49	RK	01 January 2020	LPG-SG	106	106	96	80	71	68	40	40	36.1	30.1886	27.1	26.6
50	AC	01 January 2020	LPG-SG	117	117	103	90	78	71	35.3474	35.3474	33.2	27.1903	23.1	21.9
51	GS	01 January 2020	LPG-SG	118	118	109	98	82	74	42.446	42.446	37.6	35.2517	29	24.9
52	RK	01 January 2020	LPG-SG	140	140	120	100	89	81	58.3333	58.3333	49.5	41.6666	33.1	28.6
53	CK	31 August 2018	SG	109	109	99	88	79	73	40.0735	40.0735	38.2	35.3529	29.4	27.7
54	IB	01 February 2020	LPG-SG	104	104	98	82	74	76	38.8059	38.8059	36.1	30.597	26.1	27.1
55	AK	01 February 2020	LPG-SG	110	110	98	85	79	72	45.2674	45.2674	41.2	34.9794	27.4	24.4
56	GS	01 February 2020	LPG-SG	129	129	107	103	93	86	46.4028	46.4028	42.5	37.0503	29.8	25.8
57	SB	01 March 2020	LPG-SG	165	165	156	122	100	91	56.5068	56.5068	54.2	41.7808	34.1	29.6
58	NJ	01 October 2020	LPG-SG	134	134	121	108	99	97	47.5177	47.5177	44.1	38.2978	37.1	36.6
59	GB	01 October 2020	LPG-SG	122	122	114	101	93	93	51.476	51.476	48.2	42.616	35.1	35.1
60	MA	01 October 2020	LPG-SG	135	135	119	104	91	89	46.712	46.712	43.1	35.9861	30.1	29.9
61	S	01 October 2020	LPG-SG	100	100	92	84	73	74	35.087	35.087	33.2	29.4736	25.6	26
62	RT	01 November 2020	LPG-SG	115	115	100	89	74	72	44.4015	44.4015	40.1	34.3629	27.4	26.9
63	PA	01 November 2020	LPG-SG	120	120	110	99	79	77	43.1654	43.1654	40.5	35.6115	30.1	29.1
64	HK	01 November 2020	LPG-SG	95	95	85	77	75	74	40.0843	40.0843	37.5	32.4894	27.4	27
65	YG	15 September 2018	RYGB	108	108	98	92	82	79	44.4015	44.4015	40.1	34.3629	27.4	26.3
66	RM	15 October 2018	RYGB	172	172	151	130	100	91	58.3333	58.3333	49.5	41.6666	33.1	28.8
67	PD	30 October 2018	RYGB	94	94	88	81	78	77	37.037	37.037	34.567	29.3209	29.32	28.9
68	BL	25 December 2018	SG	100	100	88	80	75	75	39.8891	39.8891	36.565	31.8559	29.0858	29.08
69	BB	02 February 2019	MGB	120	120	100	90	85	85	46.875	46.875	42.9687	38.2812	28.125	28.125
70	VG	28 February 2019	MGB	96	96	88	82	78	72	40	40	36.1	30.1886	27.1	24.15
71	TS	01 May 2019	MGB	107	107	98	93	89	90	38.8059	38.8059	36.1	30.597	26.1	26.38
72	AC	19 June 2019	SG	123	123	108	105	99	96	46.875	46.875	42.9687	38.2812	28.125	27.1
73	SK	01 July 2019	RYGB	135	135	110	98	89	81	47.4505	47.4505	43.704	36.6666	35.796	30.7
74	PD	25 September 2019	RYGB	106	106	102	96	92	89	40	40	36.1	30.1886	27.1	26.6
75	KK	01 November 2019	RYGB	117	117	110	105	96	93	35.3474	35.3474	33.2	27.1903	23.1	21.9
76	SS	01 January 2020	RYGB	118	118	109	100	91	89	42.446	42.446	37.6	35.2517	29	24.9
77	IS	08 May 2020	SG	140	140	128	112	100	96	58.3333	58.3333	49.5	41.6666	33.1	28.6
78	GK	03 August 2020	SG	109	109	103	93	81	82	40.0735	40.0735	38.2	35.3529	29.4	27.7
79	NK	03 December 2020	MGB	104	104	99	89	81	79	38.8059	38.8059	36.1	30.597	26.1	27.1
80	NB	02 February 2021	RYGB	110	110	106	99	83	79	45.2674	45.2674	41.2	34.9794	27.4	24.4
81	NK	04 April 2021	RYGB	129	129	118	106	92	84	46.4028	46.4028	42.5	37.0503	29.8	25.8
82	HK	09 June 2021	MGB	165	165	155	134	109	101	56.5068	56.5068	54.2	41.7808	34.1	29.6
83	JS	30 August 2021	MGB	134	134	126	110	99	96	47.5177	47.5177	44.1	38.2978	37.1	36.6
84	BB	11 November 2021	RYGB	122	122	116	100	89	85	51.476	51.476	48.2	42.616	35.1	35.1
85	HK	01 January 2022	SG	135	135	130	120	110	101	46.712	46.712	43.1	35.9861	30.1	29.9
86	BK	25 February 2022	SG	100	100	96	91	87	85	35.087	35.087	33.2	29.4736	25.6	26

SR. NO	NAME	PRE-OPERATIVE HB1Ac	0M	1M	3M	6M	12M	PRE-OPERATIVE FBS	0M	1M	3M	6M	12M	PRE-OPERATIVE SYSTOLIC BP	PRE-OPERATIVE DIASYSTOLIC BP	0M		1M		3M		6M	
43	NS	7	7	6.7	6.4	5.4	5.3	144	144	121	109	102	100	110	80	110	80	110	80	130	90	110	80
44	MK	8.6	8.6	8.2	7.5	6.7	5.8	197	197	176	166	126	105	122	80	110	80	110	80	110	80	110	80
45	BS	7.6	7.6	7.4	6.8	5.9	5.3	172	172	154	128	117	128	120	90	120	90	120	90	122	80	120	90
46	RK	7.2	7.2	7	6.6	5.8	5.3	160	160	149	125	101	129	120	80	120	80	120	80	120	90	120	80
47	MG	9.5	9.5	9.2	8.3	8.5	6	224	224	210	198	160	139	138	88	130	80	130	80	120	80	130	80
48	CK	12	12	11.6	9.8	9.6	6.9	201	292	280	252	166	152	120	80	120	80	120	80	110	70	120	80
49	RK	7	7	6.6	5.9	5.6	5.4	186	201	142	126	115	103	140	90	110	90	110	90	120	80	110	90
50	AC	6.9	6.9	6.3	6.1	6	6.1	177	280	170	128	111	110	134	70	110	70	110	70	120	82	110	70
51	GS	7.1	7.1	6.9	6.6	6.5	6.1	181	147	114	116	122	129	110	80	120	90	120	90	120	80	120	90
52	RK	6.4	6.4	6.3	6	6	6.1	111	176	145	109	90	103	110	80	122	80	122	80	124	88	122	80
53	CK	6.7	6.7	6.5	6.1	6.3	6.1	156	160	137	129	101	105	130	90	123	88	123	88	120	80	123	88
54	IB	6.2	6.2	6	5.8	5.7	5.9	126	158	135	120	99	103	120	80	120	80	120	80	120	80	120	80
55	AK	6.9	6.9	6.6	6.3	5.9	6	166	147	136	116	111	109	130	70	126	88	126	88	130	90	126	88
56	GS	7.9	7.9	7.5	7.1	6.6	6.5	123	195	168	121	101	93	140	80	110	70	110	70	120	70	110	70
57	SB	8	8	7.8	7.7	6.8	6.5	189	310	234	119	129	103	136	80	120	80	120	80	130	80	120	80
58	NJ	6.4	6.4	6.3	6	6.1	5.9	133	152	106	126	104	105	120	80	120	82	120	82	120	80	120	82
59	GB	8.1	8.1	7.9	7.3	6.9	6.3	172	144	109	120	135	120	110	80	120	80	120	80	110	90	120	80
60	MA	6.6	6.6	6.4	6.2	6.2	6.1	119	197	166	110	97	109	140	90	124	88	124	88	110	70	124	88
61	S	7.6	7.6	7.4	6.9	6.4	6.3	199	172	128	130	145	126	130	90	120	80	120	80	120	90	120	80
62	RT	9.2	9.2	8.9	8.7	7.1	6.5	210	160	125	110	149	105	110	80	120	80	120	80	122	80	120	80
63	PA	9.7	9.7	9.3	8.9	7.7	6.9	199	224	198	111	156	120	120	70	130	90	130	90	123	88	130	90
64	HK	8.4	8.4	8.1	7.1	6.9	6.6	181	292	252	160	113	110	140	90	120	70	120	70	120	80	120	70
65	YG	7.1	7.1	6.8	6.7	6	5.7	158	158	145	135	90	95	120	80	130	80	130	80	126	88	140	90
66	RM	7.5	7.5	7.1	6.9	6.1	5.8	176	176	136	120	110	105	130	90	120	80	120	80	110	70	134	70
67	PD	9.9	9.9	9.3	8	8.1	6.7	199	260	233	204	145	103	110	80	110	90	110	90	120	80	110	80
68	BL	8	8	7.7	7.4	6.6	6	190	190	170	158	135	120	122	80	110	70	110	70	120	80	110	80
69	BB	8.5	8.5	8	7.8	5.8	5.5	201	201	167	142	158	119	120	90	120	90	120	90	110	80	130	90
70	VG	10	10	9.4	8.9	6.9	5.9	200	280	212	170	144	123	120	80	122	80	122	80	120	70	120	80
71	TS	6.9	6.9	6.5	6.1	5.5	5.6	147	147	129	114	100	102	140	80	123	88	123	88	140	90	130	70
72	AC	7.3	7.3	7.1	6.6	6.2	6	176	176	158	145	104	112	130	70	120	80	120	80	120	80	140	80
73	SK	7.2	7.2	6.9	6.3	6.1	5.3	160	160	150	137	102	105	140	90	126	88	126	88	130	90	136	80
74	PD	8	8	7.8	7.7	6.8	6.5	126	158	135	120	99	103	130	70	124	88	124	88	138	88	110	80
75	KK	6.4	6.4	6.3	6	6.1	5.9	166	147	136	116	111	109	130	70	120	80	120	80	120	80	120	70
76	SS	8.1	8.1	7.9	7.3	6.9	6.3	123	195	168	121	101	93	130	70	120	80	120	80	140	90	140	90
77	IS	6.6	6.6	6.4	6.2	6.2	6.1	189	310	234	119	129	103	130	70	130	90	130	90	134	70	120	80
78	GK	7.6	7.6	7.4	6.9	6.4	6.3	133	152	106	126	104	105	130	70	120	70	120	70	110	80	130	90
79	NK	9.2	9.2	8.9	8.7	7.1	6.5	172	144	109	120	135	120	130	70	130	80	130	80	110	80	110	80
80	NB	9.7	9.7	9.3	8.9	7.7	6.9	119	197	166	110	97	109	130	70	120	80	120	80	130	90	122	80
81	NK	8.4	8.4	8.1	7.1	6.9	6.6	199	172	128	130	145	126	130	70	110	90	110	90	120	80	120	90
82	HK	7.1	7.1	6.8	6.7	6	5.7	210	160	125	110	149	105	130	70	110	70	110	70	120	80	120	80
83	JS	7.5	7.5	7.1	6.9	6.1	5.8	199	224	198	111	156	120	130	70	120	90	120	90	120	80	138	88
84	BB	9.9	9.9	9.3	8	8.1	6.7	181	292	252	160	113	110	130	70	122	80	122	80	120	80	120	80
85	HK	8	8	7.7	7.4	6.6	6	158	158	145	135	90	95	120	70	123	88	123	88	120	80	140	90
86	BK	8.5	8.5	8	7.8	5.8	5.5	176	176	136	120	110	105	120	70	120	80	120	80	120	80	134	70

SR. NO	NAME	12M		PRE-OPERARTIVE HDL	0M	1M	3M	6M	12M	PRE-OPERATIVE LDL	0M	1M	3M	6M	12M	PRE-OPERATIVE SCA2	0M	1M	3M	6M	12M	EARLY EPISODES OF NAUSEA AND VOMITING
43	NS	110	80	39	39	48	48	60	69	127	127	121	119	105	79	8.9	8.9	8.9	9.3	9.3	9.3	YES
44	MK	110	80	41	41	45	45	60	70	102	102	101	89	86	85	9.5	9.5	9.5	8.9	8.9	8.9	NO
45	BS	120	90	29	29	35	35	60	69	91	91	90	87	89	88	9.9	9.9	9.9	9.4	9.4	9.4	YES
46	RK	120	80	48	48	50	50	60	68	117	117	114	112	105	95	10.2	10.2	10.2	9.6	9.6	9.6	NO
47	MG	130	80	46	46	48	48	59	75	98	98	96	88	85	65	8.6	8.6	8.6	8.3	8.3	8.3	YES
48	CK	120	80	50	50	54	54	55	58	105	105	103	100	92	62	8.9	8.9	8.9	9.1	9.1	9.1	NO
49	RK	110	90	35	35	39	39	79	80	115	115	110	98	89	69	9.1	9.1	9.1	9	9	9	NO
50	AC	110	70	42	42	45	45	60	70	126	126	128	118	109	71	8.9	8.9	8.9	7.8	7.8	7.8	YES
51	GS	120	90	45	45	46	46	80	85	118	118	112	108	109	72	9.3	9.3	9.3	8.9	8.9	8.9	NO
52	RK	122	80	22	22	36	36	56	66	130	130	124	110	89	76	9.5	9.5	9.5	9.1	9.1	9.1	NO
53	CK	123	88	30	30	38	38	60	65	132	132	128	112	99	79	8.9	8.9	8.9	8.7	8.7	8.7	YES
54	IB	120	80	31	31	37	37	40	60	120	120	121	116	105	80	9.3	9.3	9.3	8.5	8.5	8.5	NO
55	AK	126	88	43	43	48	48	50	58	121	121	119	114	107	85	8.9	8.9	8.9	9.4	9.4	9.4	YES
56	GS	110	70	50	50	55	55	68	68	134	134	130	120	100	74	9.4	9.4	9.4	9.1	9.1	9.1	NO
57	SB	120	80	41	41	48	48	55	60	112	112	110	106	104	96	9.6	9.6	9.6	9.3	9.3	9.3	NO
58	NJ	120	82	38	38	40	40	60	71	141	141	135	128	125	98	9.9	9.9	9.9	9.5	9.5	9.5	YES
59	GB	120	80	49	49	55	55	65	68	129	129	122	114	100	91	8.9	8.9	8.9	8.5	8.5	8.5	NO
60	MA	124	88	41	41	46	46	66	70	128	128	124	111	109	92	10	10	10	9.6	9.6	9.6	YES
61	S	120	80	55	55	57	57	77	80	117	117	116	104	107	60	9.8	9.8	9.8	8.9	8.9	8.9	YES
62	RT	120	80	37	37	42	42	72	87	136	136	130	120	115	68	8.7	8.7	8.7	9.1	9.1	9.1	NO
63	PA	130	90	38	38	46	46	56	60	121	121	120	106	100	75	7.9	7.9	7.9	8.1	8.1	8.1	YES
64	HK	120	70	40	40	45	45	50	65	119	119	116	103	100	96	9.9	9.9	9.9	8.1	8.1	8.1	NO
65	YG	140	90	29	29	35	35	60	66	98	98	95	88	78	68	9.5	9.5	9.5	9.6	9.6	9.6	NO
66	RM	134	70	40	40	43	43	64	67	105	105	101	100	100	99	9.7	9.7	9.7	8.7	8.7	8.7	YES
67	PD	110	80	49	49	47	47	67	70	115	115	110	98	100	100	9.8	9.8	9.8	9.3	9.3	9.3	NO
68	BL	110	80	48	48	49	49	65	71	126	126	120	118	95	90	8.9	8.9	8.9	8.9	8.9	8.9	YES
69	BB	130	90	45	45	46	46	66	76	118	118	116	108	99	89	9.8	9.8	9.8	9.3	9.3	9.3	YES
70	VG	120	80	34	34	39	39	70	75	130	130	126	110	92	88	9.9	9.9	9.9	9.1	9.1	9.1	NO
71	TS	130	70	42	42	43	43	70	72	132	132	126	112	100	80	8.9	8.9	8.9	9	9	9	NO
72	AC	140	80	26	26	30	30	65	73	120	120	116	116	104	70	9.1	9.1	9.1	9.3	9.3	9.3	YES
73	SK	136	80	49	49	50	50	60	70	121	121	119	114	115	74	9	9	9	8.9	8.9	8.9	NO
74	PD	110	80	41	41	45	45	55	60	115	115	114	110	100	76	8.7	8.7	8.7	9.3	9.3	9.3	YES
75	KK	120	70	29	29	35	35	64	69	126	126	120	105	94	87	7.8	7.8	7.8	8.1	8.1	8.1	NO
76	SS	140	90	48	48	50	50	70	75	118	118	116	100	92	77	9.6	9.6	9.6	9.3	9.3	9.3	YES
77	IS	120	80	46	46	48	48	60	77	130	130	120	125	122	76	9.5	9.5	9.5	9.3	9.3	9.3	NO
78	GK	130	90	50	50	54	54	60	71	132	132	118	120	111	95	9.4	9.4	9.4	9.5	9.5	9.5	NO
79	NK	110	80	35	35	39	39	50	72	120	120	115	105	100	74	9.6	9.6	9.6	9.1	9.1	9.1	YES
80	NB	122	80	42	42	45	45	65	73	121	121	114	107	93	79	9.9	9.9	9.9	9.5	9.5	9.5	NO
81	NK	120	90	45	45	46	46	65	74	134	134	125	130	125	85	9.8	9.8	9.8	9.1	9.1	9.1	YES
82	HK	120	80	22	22	36	36	50	66	112	112	109	100	99	74	9.5	9.5	9.5	9.4	9.4	9.4	YES
83	JS	138	88	30	30	38	38	50	60	141	141	135	135	130	78	9.8	9.8	9.8	9.2	9.2	9.2	YES
84	BB	120	80	31	31	37	37	50	65	129	129	124	125	120	56	8.9	8.9	8.9	8.7	8.7	8.7	NO
85	HK	140	90	43	43	48	48	52	62	128	128	124	125	125	98	9.3	9.3	9.3	9.1	9.1	9.1	NO
86	BK	134	70	50	50	55	55	57	66	117	117	115	110	107	74	9.7	9.7	9.7	9.5	9.5	9.5	YES

SR. NO	NAME	INFECTION	SHOCK	DIARRHOEA	ANASTMOTIC LEAK	BOWEL OBSTRUCTION	INCISIONAL HERNIA	VIT B12 MALNUTRITION	GASTRO JEJUNAL STENOSIS STENOSIS	GERD	GI BLEED	GASTRIC FISTULA
43	NS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
44	MK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
45	BS	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
46	RK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
47	MG	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
48	CK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
49	RK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
50	AC	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
51	GS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
52	RK	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
53	CK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
54	IB	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
55	AK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
56	GS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
57	SB	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
58	NJ	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
59	GB	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
60	MA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
61	S	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
62	RT	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
63	PA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
64	HK	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
65	YG	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
66	RM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
67	PD	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
68	BL	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
69	BB	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
70	VG	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
71	TS	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
72	AC	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
73	SK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
74	PD	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
75	KK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
76	SS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
77	IS	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
78	GK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
79	NK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
80	NB	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
81	NK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
82	HK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
83	JS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
84	BB	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
85	HK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
86	BK	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO

No. BFUHS/2K21p-III/ 19-

Date 05/11/21

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.10.2021 has approved the plan of thesis of **Ramandeep Singh**, a student of your college for **MS General Surgery** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
To compare outcome at the end of 1 year among various bariatric surgery procedures.

Supervisor
Dr. P. S. Nain
Prof.,
Dept. of Surgery,
DMCH, Ludhiana.

Co-Supervisor

Dr. Ashish Ahuja
Prof.,
Dept. of Surgery,
DMCH, Ludhiana.

The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

133. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
134. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

TO COMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

Master of Surgery

In

GENERAL SURGERY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

MARCH 2021

Dr. RAMANDEEP SINGH

DEPARTMENT OF GENERAL SURGERY
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA
LUDHIANA, PUNJAB-141001

ABSTRACT OF PLAN OF THESIS

Title	TO COMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES
For the degree of	M.S. General Surgery
Name of the candidate	Dr Ramandeep Singh
Supervisor	Dr. P.S.Nain, Professor, Department of Surgery, DMCH, Ludhiana
Co-supervisor	Dr. Ashish Ahuja, Professor, Department of Surgery, DMCH, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: By reducing food intake and nutrition absorption, bariatric surgery is an effective treatment option for not only long-term weight loss but also declining the risk of cardiovascular diseases,reducing obesity-related comorbidities. The most common bariatric surgeries for obesity are Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy, sleeve gastrectomy with jejunal bypass (SGJB). RYGB surgery could reduce food intake and absorption by directly linking small stomach capsule and small intestine, which has been studied earlier and performed more frequently in patients with weight loss and diabetes. Moreover RYGB is most effective in treating patients with obesity accompanied by type 2 diabetes. Sleeve gastrectomy would remove about 70% of stomach volume and keep the main part responsible for digesting food. In addition to less intake, sleeve gastrectomy reduces the production of ghrelin to suppress appetite. About 10–15 BMI points or 70% excess weight could decrease within 2 years after surgery. SGJB is an improvement of sleeve gastrectomy, specifically for the treatment of insulin resistance and type 2 diabetes. However, little is known about differences of the three kinds of bariatric surgery.

Aim of Study: To compare outcome at the end of 1yr among various Bariatric surgery procedures.

Materials & methods: Information shall be collected through pre-designed proforma for each patient chosen to be a part of the study with detailed history, clinical examination and complete investigational workup.

Clinical Significance: The study will analyse the long term effect of various bariatric procedures on the weight loss, remission of various co- morbities like T_2DM, HTN, CAD and complication like infection, anastmotic leak rates in various bariatric procedures.

Keywords: Bariatric surgery, RYGB, SG, AGB, WEIGHT LOSS, remission of T_2DM, HTN.

(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"TO COMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES"** exist in the Department of Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

Dr. P. S. Nain
Professor
Department of General Surgery
DMCH, Ludhiana

Co-Supervisor

Dr. Ashish Ahuja
Professor
Department of General Surgery
DMCH, Ludhiana

Head of the Department

Dr. Jaspal Singh
Professor & Head
Department of General Surgery
DMCH, Ludhiana

Place : _____

Date : _____

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Ramandeep Singh
Department	General Surgery
Topic of Thesis	TO COMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES
Likely date of appearing in PG examination	MAY 2023
Date of enrollment	26th July, 2020
Name of Head of Department	Dr. Jaspal Singh
1) **Supervisor** 2) **Co-Supervisor**	Dr. P. S. Nain Dr. Ashish Ahuja
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / No

Dr. Sandeep Puri
Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
Chairman
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	DR.RAMANDEEP SINGH KALRA ROAD, GARHDIWALA, DISTT HOSHIARPUR, PIN 144207
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL
3	COURSE OF STUDY AND SUBJECT	MS GENERAL SURGERY
4	DATE OF ADMISSION OF COURSE	27TH JULY 2020
5	TITLE OF THE TOPIC	TO COMPARE OUTCOME AT THE END OF 1YR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Bariatric surgery has proven to be a treatment of choice for morbid obesity [1]. It is recommended for patients with body mass index (BMI) above 40 kg/m^2 or higher than 35 kg/m^2 when associated with comorbidities which include the different components of metabolic syndrome and type 2 diabetes [2]. Weight loss obtained after bariatric surgery is associated with a highly significant reduction in cardiovascular risk factors [3]. More recently, improvement or remission of diabetes has been observed following bariatric surgery in obese patients with type 2 diabetes and mortality rate linked to diabetes was consequently significantly reduced [4]. Weight loss induced by bariatric surgery is a major factor of diabetes improvement [5]. However, in several studies, the resolution of diabetes has often been observed before a significant weight loss has been obtained [6-7]. The early postsurgical improvement of diabetes suggested a major physiopathological role for changes in gut hormone secretion [8]. As a matter of fact, a decrease in plasma levels of ghrelin, an orexigenic peptide, has been described following gastric bypass for morbid obesity [9-11]. The involvement of other intestinal peptides like GLP-1 (hindgut hypothesis) [12-13] and neuropeptide YY [14-15] or a decreased secretion of anti-incretin hormones (foregut hypothesis) [16-17] has been proposed to explain the rapid remission of diabetes after bariatric surgery. Otherwise, Roux-en-Y bypass (RYGB) that excludes the duodenum from the nutriments' route and profoundly modifies the gut microbial metabolic cross-talk [18] has been shown to improve insulin resistance more rapidly than sleeve gastrectomy [15].

The most common bariatric surgeries for obesity therapy are Roux-en-Y gastric bypass (RYGB) [19], sleeve gastrectomy [20], and sleeve gastrectomy with jejunal bypass (SGJB) [21]. RYGB surgery could reduce food intake and absorption by directly linking small stomach capsule and small intestine, which have performed more frequently in patients with weight loss and diabetes. Moreover RYGB is most

effective in treating patients with obesity accompanied by type 2 diabetes. Sleeve gastrectomy would remove about 70% of stomach volume and keep the main part responsible for digesting food. In addition to less intake, sleeve gastrectomy reduces the production of ghrelin to suppress appetite. About 10–15 BMI points or 70% excess weight could decrease within 2 years after surgery. For those with a higher BMI (over 40) and difficulty in reducing their food intake, sleeve gastrectomy is ideal for weight loss, as is currently widely used. SGJB is an improvement of sleeve gastrectomy, specifically for the treatment of insulin resistance and type 2 diabetes. However, little is known about differences of the three kinds of bariatric surgery.

Here we will compare weight loss, resolution of various co-morbidities at the end of one year in the patients of bariatric surgery retrospectively and prospectively.

6.2 REVIEW OF LITERATURE

Given this relatively bleak picture, it is not surprising that bariatric surgery has increased in popularity due to its ability to produce long-term weight loss that is superior to traditional weight loss treatments in both magnitude and durability. Additionally, some bariatric procedures reduce overall mortality despite the inherent risks of surgery itself [9, 10], an effect that is perhaps due to the superior ability for bariatric surgery among weight loss treatments to induce long-term metabolic benefits. Reduced incidence of diabetes [11], heart disease have been reported in individuals who have received bariatric surgery. The effects on some of these elements are powerful enough that for some patients pharmacological treatment for diabetes and other elements of the metabolic syndrome such as hyperlipidemia and hypertension can often be discontinued after surgical treatment [14].

The first weight loss surgeries were performed by Drs. Mason and Ito in the 1950s [15]. The earliest procedure, the jejuno-ileal bypass (JIB) surgery, redirected nutrient flow to bypass most of the small intestine and was intended to produce weight loss by malabsorption. Because of a severe syndrome of complications including arthritis, skin problems, and liver failure that occurred after this procedure, JIB is no longer used. Later Mason and Ito [16] in 1967, introduced a gastric bypass procedure that produced weight loss without these side effects. This procedure was based on the weight loss observed after partial gastric resection for the treatment of gastric ulcers. This procedure involved the creation of a small stomach pouch connected to a limb of distal intestine, bypassing the proximal intestine. The contemporary Roux-en-Y gastric bypass (RYGB) procedure is a modification of this early procedure. The RYGB has a much smaller gastric pouch size than Mason and Ito's original procedure, and the intestinal component of the surgery has been modified to avoid bile reflux, but the basic principle remains the same. Another currently used bariatric procedure is adjustable gastric banding (AGB), a restrictive procedure in which a saline-filled silicon band is fitted around the stomach near the esophageal junction [17]. The level of gastric restriction imposed by the

band may be adjusted by infusing saline via a sc port. Together, AGB and RYGB are the two most commonly performed bariatric procedures[18].

Vertical sleeve gastrectomy (VSG), another procedure that has received increasing attention over the past decade, involves the removal of 80% or more of the stomach, including the fundus and greater curvature. VSG was first described in 1998 as a part of the biliopancreatic diversion-duodenal switch procedure [19]. It has since been used alone as a staging procedure in super-obese patients [body mass index (BMI) > 50 kg/m^2] [20–24] due to its lack of invasiveness and to its ability to produce significant weight loss. Increasingly, VSG is gaining popularity as an independent weight loss procedure for all degrees of obesity. The procedure is attractive as a single-stage weight loss intervention because it entails less surgical risk and reduced postsurgical complications. Additional benefits include the maintenance of an open pathway for future endoscopic studies, the lack of need to implant foreign material that may fail, and low risk for malabsorption of either fat-soluble vitamins or drugs. Complication rates range from 0–24% for VSG, and the procedure has an overall mortality rate of 0.39%[22].

Increasing evidence highlights VSG as a procedure that can produce substantial weight loss comparable to that produced by more invasive and complex procedures like RYGB. A recent meta-analysis[23] directly comparing studies of VSG, RYGB, and AGB demonstrated similar weight loss after RYGB and VSG that was superior in magnitude and durability to the weight loss induced by AGB. Despite a rapidly expanding body of data surrounding these surgeries, it is yet unclear what physiological mechanisms underlie the ability for each surgery to produce sustained weight loss as well as metabolic improvement.

Bariatric surgery has been established as the stand-alone treatment for morbid obesity. Currently, it is the only therapeutic option that results in substantial and durable weight loss. Laparoscopic Roux-en-Y gastric bypass LRYGB) and laparoscopic sleeve gastrectomy (LSG) are the 2 most popular bariatric procedures performed. However, their long-term

effective- ness for weight loss and co-morbidity resolution has not been sufficiently compared.

Documentation of long-term weight loss is a hassle in bariatric surgery, since a substantial proportion of patients are lost to follow-up several years after enrollment into the weight loss program. Additionally, some LSG patients later undergo revisional surgery due to inadequate weight loss or weight regain. For this reason, it has not been adequately determined which bariatric procedure, LRYGB or LSG, results in more weight loss or better co-morbidity resolution.

Here we will compare weight loss, resolution of various co-morbidities, complications at the end of one year in patients of bariatric surgery retrospectively and prospectively.

6.3 AIMS AND OBJECTIVES OF THE STUDY

AIMS

To compare outcome at the end of 1yr among various bariatric surgery procedures

OBJECTIVE

1. To compare the post operative outcomes in terms of change in BMI.
2. To compare the post operative outcomes in terms of control of Diabetes, and/ or Hypertension, Dyslipidemias
3. To compare the post operative complication among various procedures.

7. MATERIALS AND METHODS

7.1 Source of Data

The Retrospective and prospective study will be conducted among the patients admitted to department of general surgery, Dayanand Medical College and hospital, Ludhiana who had undergone bariatric procedures

7.2 METHOD OF COLLECTION OF DATA

Information shall be collected through pre-designed proforma for each patient chosen to be a part of the study with detailed history, clinical examination, through IPD, OPD and telephonic follow-ups.

BMI (BODY MASS INDEX)- : Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters(kg/m^2)

IF BMI

- <18.5- UNDERWEIGHT
- >18.5 TO <25 – NORMAL
- >25 TO <30 – OVERWEIGHT
- >30 – OBESITY (class 1 obesity- BMI 30 to <35, class 2 – 35 to <40 , Class 3 - >40)

Type 2 Diabetes Mellitus

- HbA1c ≥ 6.5 % (≥ 48 mmol/mol)
- Random plasma glucose ≥ 200 mg/dl (≥11.1 mmol/l)
- Fasting plasma glucose ≥ 126 mg/dl (≥7.0mmol/dl) OGTT 2-hour glucose in venous plasma ≥ 200 mg/dl (≥ 11.1 mmol/l)

HYPERTENSION - Hypertension is diagnosed if, when it is measured on two different intervals (>6hr apart), the systolic blood pressure readings on both is ≥140 mmHg and/or the diastolic blood pressure readings on both is ≥90 mmHg.

INCLUSION CRITERIA-

Patients considered for inclusion in this study are

1. BMI>32kg/m^2
2. AGE 18 YRS TO 60YRS OF AGE
3. UNDERGONE BARIATRIC SURGERY FOR WEIGHT LOSS OR CO-MORBIDITY RESOLUTION

EXCLUSION CRITERIA-

1. LACK OF CONSENT.
2. PATIENTS REQUIRING BARIATRIC RE-PROCEDURE
3. ADVANCED MALIGNANCIES

Patients with

SAMPLE SIZE – Retrospective with Prospective study that will include post operative patients who have undergone bariatric surgery from 1ST January 2017 to 28th February 2022

FOLLOW UP PERIOD – will be done retrospectively and prospectively for 1 year at 0,1,3, 6, 12 months post operatively

DURATION OF STUDY – 1ST January 2017 to 28th February 2022

OUTCOME

To compare weight loss, resolution of various co-morbidities, complications in patients who underwent different bariatric surgery procedures

STATISTICAL ANALYSIS

Data will be described in the terms of range, mean +/- standard deviation, frequencies (number of cases), and relative frequencies (percentages) as appropriate. Comparison of quantitative variables will be done using paired t-test. A probability value of less than 0.05 will be considered statistically significant. All statistical calculations will be done using SPSS ver.21.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Yes, Investigations – HBA_{1C}, FBS, HDL, LDL LEVELS, $S.CA^{+2}$ LEVELS, VITAMIN B_{12} LEVELS OF PATIENTS.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached here with

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PROFORMA

Sr. No. ___

NAME : **AGE/SEX :**

M.R.D.NO: **Adm. NO :**

DOA : **DOD :**

ADDRESS :

Occupation :

Past History :

PREOPERATIVE PARAMETERS

WEIGHT (kg)	
HEIGHT (m)	
BMI	
BLOOD PRESSURE	
PULSE	

Medical Treatment for obesity taken(if any)

Signature of Candidate **Signature of Supervisor**

COMORBIDITIES (IF ANY)

DIABETES MELLITUS- HbA_1C	
FBS	
HYPERTENSION	
CAD	
HDL	
LDL	
PCOD	
OSA	
ARTHIRITIS	

Procedure Performed (Date & Time):

Time since Procedure Performed :

Signature of Candidate **Signature of Supervisor**

Post operative Parameters

TIME SINCE SURGERY (IN MONTHS) →

	0 months	1 months	3 months	6 months	12 months
WEIGHT (kg)					
BMI(kg/m2)					
HBA_1C					
FBS					
BLOOD PRESSURE					
HDL					
LDL					
S. Ca+2 levels					

Signature of Candidate **Signature of Supervisor**

POST OPERATIVE COMPLICATIONS (IF ANY)

EARLY EPISODES OF NAUSEA AND VOMITING	
INFECTION	
SHOCK	
DIARRHOEA	
ANASTMOTIC LEAK	
BOWEL OBSTRUCTION	
CHOLELITHIASIS	
INCISIONAL HERNIA	
VIT B_{12} MALNUTRITION	
GASTRO JEJUNAL STENOSIS	
GERD	
GI BLEED	
GASTRIC FISTULA	

Signature of Candidate **Signature of Supervisor**

RESOLUTION OF CO-MORBIDITY (IF ANY):-	

Signature of Candidate

Signature of Supervisor

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o..... am willing to participate in the study **"TO COMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name:

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"TO COMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"TO ÇOMPARE OUTCOME AT THE END OF 1 YEAR AMONG VARIOUS BARIATRIC SURGERY PROCEDURES" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ